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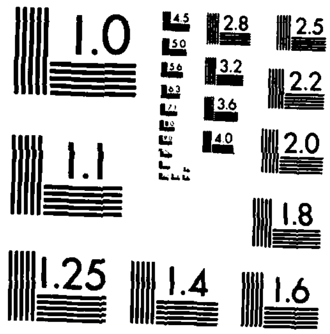
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Airport and Airway System Cost Allocation

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ABSTRACT

Projected Federal Aviation Administration (FAA) costs are allocated to users of the air traffic control system as part of the study on Airport and Airway Costs and User Cost Responsibility during the period FY77-FY86. A review of the economic theory of cost allocation is conducted including the procedures explored in a previous 1973 Cost Allocation Study. A modified version of the long-run marginal cost approach is selected as the preferred methodology. This method is combined with engineering techniques to develop a set of allocation procedures for each of the FAA budget categories. The cost responsibility of air carrier, general aviation and military (including government) user groups are then determined by applying the procedures to two different sets of cost projections; (1) a baseline set assuming continuation of historical relationships between FAA expenditures and user activity and (2) an alternative set assuming introduction of planned air traffic control enhancements.

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SUMMARY

This report forms one part of an airport and airway cost allocation study being conducted by MITRE METREK for the FAA Office of Aviation Policy. In this report, cost allocation theory and methods are reviewed, and a preferred method is selected and applied to airport and airway data to yield user cost allocations.

Evaluation criteria, types of costs and their treatment, and theory relevant to peak capacity costs are discussed. These general principles are then applied to a wide range of cost allocation methods which are classified as being cost-based, value-of-service oriented, and combination in nature. Using the criteria of economic efficiency, equity, ability to pay, minimization of funding deficits, and practicality, modified long-run marginal cost is selected as the preferred cost allocation method. This method initially allocates long-run marginal costs to each user group and then allocates any residual costs in inverse proportion to users' price elasticities of demand. Some costs, notably F&E and R&D, cannot be causally related to users' activity measures. It is recommended that these cost elements be assigned through engineering assessments based primarily on values derived by users and on relationships between user requirements and costs.

The percent distribution of Federal Aviation Administration (FAA) costs allocated to users of the Airport and Airway System fluctuates very little throughout the period FY77 to FY86:

Public Interest	:	16-17%
Air Carriers	:	48-50%
General Aviation	:	24-27%
Military and Government	:	8-10%

Furthermore, this distribution remains relatively constant irrespective of whether projected baseline (i.e., continuation of historical relationships between FAA expenditures and user activity levels) or whether alternative (i.e., introduction of planned Upgraded Third Generation Air Traffic Control enhancements) cost scenarios are used.

TABLE OF CONTENTS

	Page
1. INTRODUCTION	1-1
2. COST ALLOCATION THEORY AND METHODS	2-1
2.1 General Principles	2-1
2.1.1 Evaluation Criteria	2-1
2.1.2 Types of Cost and Their Treatment	2-2
2.1.3 Peak Capacity Costs	2-3
2.2 Cost-Based Allocation Methods	2-5
2.2.1 Marginal/Incremental Cost Methods	2-5
2.2.2 Average Cost Methods	2-6
2.2.3 Comparison and Evaluation	2-7
2.3 Value of Service Allocation Methods	2-7
2.3.1 Description of Methods	2-8
2.3.2 Comparison and Evaluation	2-9
2.4 Combination Cost Allocation Methods	2-9
2.4.1 Description of Methods	2-10
2.4.2 Comparison and Evaluation	2-10
2.5 Evaluation and Selection of Recommended Cost Allocation Method	2-10
3. DEVELOPMENT OF THE COST ALLOCATION METHOD	3-1
3.1 Public Interest Costs	3-1
3.2 R&D and F&E Costs	3-1
3.3 Operations and Maintenance (O&M) Costs	3-5
3.4 Grants-in-Aid	3-8
3.5 Support Costs	3-8
3.6 Summary	3-8
4. ADJUSTMENTS TO USER ALLOCATIONS	4-1
5. RESULTS OF USER COST ALLOCATION	5-1

TABLE OF CONTENTS
(concluded)

	Page
APPENDIX A: JUSTIFICATION OF MARGINAL COST PRICING	A-1
1. Introduction	A-1
2. The Allocative Penalty Arising from Failure to Price at Marginal Costs	A-1
3. Summary	A-9
APPENDIX B: PEAK-PERIOD PRICING	B-1
1. Theory	B-1
2. Analysis of Airport and Airway Peaking	B-2
APPENDIX C: REESTIMATION OF EN ROUTE O&M MARGINAL COSTS	C-1
APPENDIX D: PRICE ELASTICITIES	D-1
APPENDIX E: ALLOCATION OF R&D AND F&E PROGRAMS	E-1
APPENDIX F: DETAILED ALLOCATIONS OF FAA PROGRAM COSTS	F-1
APPENDIX G: GLOSSARY	G-1
APPENDIX H: REFERENCES	H-1
APPENDIX I: DISTRIBUTION LIST	I-1

LIST OF ILLUSTRATIONS

		Page
TABLE 2-1:	PRIMARY ADVANTAGES AND DISADVANTAGES OF CANDIDATE COST ALLOCATION METHODS	2-12
TABLE 3-1:	CATEGORIES OF FAA EXPENDITURES	3-2
TABLE 3-2:	FAA COSTS ATTRIBUTABLE TO PUBLIC INTEREST	3-4
TABLE 3-3:	PERCENTAGE ALLOCATION OF CAPITAL EXPENDITURES	3-6
TABLE 3-4:	O&M LONG RUN MARGINAL COST COEFFICIENTS	3-9
TABLE 3-5:	O&M PRICE ELASTICITIES OF DEMAND	3-10
TABLE 3-6:	FUNCTIONAL RELATIONSHIP OF SUPPORT COSTS TO OTHER BUDGET CATEGORIES	3-11
TABLE 3-7:	PROCEDURAL SUMMARY FOR COST ALLOCATION (AFTER REMOVAL OF PUBLIC INTEREST COSTS)	3-12
TABLE 5-1:	COST ALLOCATION SUMMARY FY76 CONSTANT DOLLARS IN MILLIONS	5-2
TABLE 5-2:	COST ALLOCATION SUMMARY CURRENT DOLLARS IN MILLIONS	5-3
TABLE B-1:	PEAK PERIOD ANALYSIS	B-3
TABLE C-1:	DATA BASE FOR EN ROUTE O&M MARGINAL COST RE-ESTIMATION (COSTS IN THOUSANDS OF FY76 DOLLARS)	C-3
TABLE E-1:	ELEMENTS OF F&E PROGRAMS	E-9
TABLE F-1:	ALLOCATION OF BASELINE PROGRAM COSTS IN CONSTANT DOLLARS	F-2
TABLE F-2:	ALLOCATION OF BASELINE PROGRAM COSTS IN CURRENT DOLLARS	F-12
TABLE F-3:	ALLOCATION OF ALTERNATIVE PROGRAM COSTS IN CONSTANT DOLLARS	F-22
TABLE F-4:	ALLOCATION OF ALTERNATIVE PROGRAM COSTS IN CURRENT DOLLARS	F-32

LIST OF ILLUSTRATIONS
(concluded)

		Page
FIGURE 2-1:	DEFICIT ASSOCIATED WITH MARGINAL COST PRICING	2-4
FIGURE 3-1:	COST ALLOCATION PROCEDURE	3-3
FIGURE A-1:	ALTERNATIVE AIR ROUTES WITH DIFFERENT MARGINAL COSTS BUT IDENTICAL FARES	A-2
FIGURE A-2:	CONSUMER AND PRODUCER SURPLUS AT EQUILIBRIUM PRICE	A-4
FIGURE A-3:	CONSUMER AND PRODUCER SURPLUS AT SUPER-EQUILIBRIUM PRICE	A-5
FIGURE A-4:	CONSUMER AND PRODUCER SURPLUS AT SUB-EQUILIBRIUM PRICES	A-7
FIGURE E-1:	ALLOCATION OF R&D TRUST FUND RESPONSIBILITY (LESS PUBLIC INTEREST PROGRAMS)	E-3
FIGURE E-2:	ALLOCATION OF TOTAL F&E COST RESPONSIBILITY	E-4
FIGURE E-3:	ALLOCATION OF TERMINAL RADAR F&E COST RESPONSIBILITY	E-5
FIGURE E-4:	ALLOCATION OF TERMINAL AUTOMATION F&E COST RESPONSIBILITY	E-6
FIGURE E-5:	ALLOCATION OF OTHER TERMINAL F&E COST RESPONSIBILITY	E-7
FIGURE E-6:	ALLOCATION OF NAVAID AND LANDING AID COST RESPONSIBILITY	E-8
FIGURE E-7:	ALLOCATION OF COST RESPONSIBILITIES BETWEEN AIR CARRIER AND MILITARY	E-11

1. INTRODUCTION

Allocations of projected Federal Aviation Administration (FAA) costs to users of the Airport and Airway System during the period FY77 through FY86 are presented in this report. The allocations are the culmination of a cost allocation study being performed by The MITRE Corporation for the FAA Office of Aviation Policy.

To gain a better perspective of cost allocation, both economic theory and procedures used by the 1973 Cost Allocation Study (Reference 2) are first examined. A preferred methodology is then adopted and detailed allocation procedures are developed for each of the major FAA budget categories.

Costs of serving the public interest, air carriers, general aviation and military & government aviation are determined by applying the allocation procedures to two sets of cost projections developed in an earlier phase of this project (Reference 10); (1) a baseline set of cost projections assuming continuation of historical relationships between Airport and Airway expenditures and user activity levels and (2) an alternative set of cost projections assuming the introduction of capital intensive programs associated with the Upgraded Third Generation Air Traffic Control System.

2. COST ALLOCATION THEORY AND METHODS

This chapter summarizes fundamental principles and issues of economic theory related to airport and airway cost allocation. Alternative cost allocation methods are explored.* These alternative methods are based on cost factors, value of service factors, or a combination of the two. A preferred cost allocation method is selected based on evaluation criteria described in Section 2.1.1.

In general, implementation of any method involves certain common computational steps: 1) assign clearly-allocable costs, 2) allocate other costs according to a basic cost allocation method, and 3) if necessary, devise procedures for allocating residual costs not covered by the first two steps.

2.1 General Principles

This section summarizes generally accepted economic theory relevant to this study. Evaluation criteria, general cost taxonomy and treatment, and methods of dealing with peak capacity costs are covered.

2.1.1 Evaluation Criteria

Multiple and sometimes conflicting evaluation criteria exist. The ones considered in selecting a preferred cost allocation method include: economic efficiency, equity, ability to pay, and minimizing or reducing funding deficits. The selection is also constrained by desirability to minimize administrative burdens, i.e., consideration of the practical problems of implementation.

A fundamental economic criterion for selecting a preferred cost allocation method is maximization of society's welfare and collective satisfactions, i.e., sum of consumer and producer surplus.** This criterion can be met, in large part, through efficiency in allocation and use of resources.

A second evaluation criterion is equity or fairness. This is a subjective criterion, and alternative concepts exist. These concepts involve equal treatment of all parties or identification of some favored and disfavored groups who are charged different

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* Most of the methods examined in this report were also evaluated in the 1973 Airport and Airway Cost Allocation Study.

** Interpersonal comparisons, which may distort this criterion, are adequately dealt with in other criteria.

TABLE 3-1

CATEGORIES OF FAA EXPENDITURES*

RESEARCH AND DEVELOPMENT

FACILITIES AND ENGINEERING

EN ROUTE CONTROL CENTERS
TERMINAL CONTROL CENTERS
FLIGHT SERVICE STATIONS
NAVIGATION SYSTEMS
OTHER F&E

OPERATIONS

EN ROUTE CONTROL CENTERS
TERMINAL CONTROL CENTERS
FLIGHT SERVICE STATIONS
OTHER FACILITIES

MAINTENANCE

EN ROUTE CONTROL CENTERS
TERMINAL CONTROL CENTERS
OTHER FACILITIES

SUPPORT

INSTALLATION AND MATERIAL SERVICES
ADMINISTRATION OF FLIGHT STANDARDS PROGRAMS
ADMINISTRATION OF MEDICAL PROGRAMS
DEVELOPMENT DIRECTION
ADMINISTRATION OF AIRPORTS
CENTRALIZED TRAINING
DIRECTION, STAFF AND SUPPORT

FACILITIES, ENGINEERING AND DEVELOPMENT

NATIONAL CAPITAL AIRPORTS

GRANTS-IN-AID

*Costs of communications & surveillance equipment are included in the costs of the associated ATC facility. Communications lease line costs are a part of the I&M category.

3. DEVELOPMENT OF THE COST ALLOCATION METHOD

The complexity of the FAA cost base (Reference 10) requires a hybrid of the allocation methods surveyed in Section 2. In keeping with the conclusions of the survey, modified long-run marginal cost techniques are applied whenever causal relationships between costs and user activities can be defined and statistically supported. Substitute allocation procedures (including those described as "engineering models") are developed for cost elements for which historical user cost responsibilities are expected to change in the future. Table 3-1 lists the categories of expenditures in the FAA cost base. Figure 3-1 presents an overall view of the cost allocation process examined in the following subsections.

3.1 Public Interest Costs

Portions of Airport and Airway System costs are incurred in public interest. They include small community service subsidies, support of military requirements of the ATC system elements, non-aviation use of weather services, and services provided in regulatory safety, medicine, and environmental programs. The identification and treatment of these costs are examined in Reference 11 and summarized in Table 3-2. Public interest costs in the context of this study are fully separable and are allocated in total to the public sector.

3.2 R&D and F&E Costs

Future improvements to the existing Airport and Airway System stress increases in safety, productivity and capacity (Reference 14). These objectives tend to shift a greater share of capital (R&D and F&E) expenditures to air carrier programs irrespective of projected activity levels. For this reason, there is no basis to conclude that historical relationships between capital spending and user demand will necessarily extend into the future. Long-run marginal cost equations cannot, therefore, be determined by analysis of historical data.

The "engineering" approach developed in lieu of long-run marginal cost methods assesses the relative value of R&D and F&E expenditures to the users. This approach subjectively estimates the relative value of providing component air traffic control services to each of the user groups based on several factors including (1) user requirements, (2) user benefits, (3) user elasticities of demand, (4) the purpose of FAA programs and services and (5) historical and expected future usage of air traffic control services. Once the relative value to each user is determined, costs are then allocated proportionately.

for allocating residual costs employed in the basic LRMC method is simply an analytic expediency. A priori, there is no reason to expect that remaining costs should be allocated as earlier-assigned costs no matter what causal foundations might be hypothesized--either marginal opportunity costs, benefits, or any other methods. Only in the special case where all users have equal desires and needs (i.e., elasticities of demand) should this be so. Thus, it appears that the basic LRMC method has a significant theoretical weakness.

Considering all factors, the modified LRMC method is recommended due primarily to its strong theoretical underpinnings and its lack of significant theoretical or practical shortcomings relative to other methods. Baumol and Bradford show that this method is generally optimal if complete cost recovery is to be accomplished (Reference 4). While the cost allocation study described in this paper reached this conclusion by comparing modified LRMC with other methods, Baumol and Bradford prove the case more strongly by showing general superiority without the need to reference other techniques. In summary, modified LRMC represents an excellent tradeoff among theoretical and practical factors.

Some airport and airway cost elements cannot be causally related to system activity measures. Many R&D and F&E costs fall into this category. These cost elements have been accrued over many years in a manner that is likely to bear little if any relationship to present or forecast measures of user activity. In such cases, it is recommended that engineering assessments be substituted for econometric estimates of marginal costs. These engineering estimates can include factors related to benefits, value of service, physical relationships between requirements/purposes and costs, and historical/future usage rates.

No matter what cost allocation method is selected, a distinct possibility exists that some present users may be forced to curtail usage. While this result may be economically appropriate, other considerations also apply to this problem. Therefore, it is recommended that any changeover to modified LRMC be made gradually to afford a transition period to those who have been operating under an earlier set of rules. There is also a need to proceed with caution due to imperfect knowledge of demand elasticities, inability to implement perfect price discrimination, and other market imperfections.

TABLE 2-1

PRIMARY ADVANTAGES AND DISADVANTAGES OF CANDIDATE COST ALLOCATION METHODS

Method	Primary Advantages *	Primary Disadvantages
Long-run marginal cost	Cost relatedness resulting in allocative efficiency; consistent & equitable	Some current users may be unable or unwilling to pay allocated charges.
User benefits/ value of service	Satisfaction of ability to pay criterion.	Highly discriminatory → different charges for similar services; Poor economic efficiency; Much subjectivity & inaccuracy in calculating underlying components.
Modified long-run marginal cost	Cost and demand relatedness resulting in *maximum* allocative efficiency**; equitable.	A small number of current users may be unable or unwilling to pay allocated charges; Some imprecision in calculating underlying components.

* As defined in this study, all methods provide complete cost recovery.

** Given the constraint of allocating all costs.

selection process that follows is based on the four criteria discussed in Section 2.1.1 (economic efficiency, equity, ability to pay, and completeness of cost recovery) as well as on practical considerations. However, the complete cost recovery criterion happens not to be a differentiating factor as all three methods satisfy this criterion equally well. The advantages and disadvantages of each method are summarized in Table 2-1.

The LRMC method provides good cost-relatedness which results in good economic efficiency. It also provides for consistent and equitable treatment of users. The primary disadvantage of this method is its potentially poor satisfaction of the ability to pay criterion. This problem occurs because this method does not consider demand characteristics.

The user benefits/value of service method provides excellent satisfaction of the ability to pay criterion. This advantage is inherent in the design of the method. The user benefits/value of service method has several significant problems. It is highly discriminatory, as different users are assigned different costs for essentially similar service. Due to lack of cost-relatedness, use of this method would result in economic inefficiency. Finally, highly subjective and possibly inaccurate assessments must be made when estimating user benefits and value of service proportions which are basic components of this method.

The modified LRMC method provides very good cost-relatedness which results in very good economic efficiency. It is an equitable method that relates users' cost allocations to marginal costs for some portion of variable costs and to price discrimination for remaining amounts. While some current users may be unable or unwilling to maintain their airport and airway activities at present levels due to financial reasons, this method's consideration of demand factors reduces the problem compared to the basic LRMC method. The problem associated with the modified LRMC method is the imprecision that exists in calculating users' price elasticities of demand. However, a good measure of the <u>relative</u> price elasticity of demand of various users is the only requirement of using this method.

The user benefits/value of service method fails to relate cost responsibility to cost incurrence, thereby virtually ignoring economic efficiency criteria. In addition, this method poses substantial implementation problems associated with quantification of benefits and value of service. This method does not have countervailing advantages that are sufficient to allow its selection as the recommended method.

The two remaining methods, LRMC and modified LRMC, differ only in the manner in which they allocate residual costs. The technique

2.4.1 Description of Methods

The two combination methods considered in this study are separable costs/remaining benefits and modified long-run marginal cost. Initially, in the separable costs/remaining benefits method, avoidable costs are assigned to each user group. Separate systems or facilities costs are then compared to total airport/airway benefits for each group. Usually, benefits will exceed separate systems costs, but not necessarily so because of economies of scale. Remaining benefits are defined by subtracting avoidable costs from the lesser of benefits or separate facilities costs. Finally, costs remaining after avoidable costs have been assigned are allocated to user groups in proportion to their respective remaining benefits.

The modified LRMC method differs from the basic LRMC method in the way that residual costs remaining after initial assignment of LRMC are allocated among users. In modified LRMC, the deficit is allocated by applying a surcharge to the product of LRMC times quantity of system usage for each user group. The percentage deviation from this LRMC product due to this surcharge varies in inverse proportion to the price elasticity of demand of each group. Thus, the least elastic users--perhaps best termed core users--pay the greatest percentage surcharge.

2.4.2 Comparison and Evaluation

In this section, combination cost allocation methods are compared, and a preferred method is selected based on the evaluation criteria of Section 2.1.1. The two methods being compared are: separable costs/remaining benefits and modified long-run marginal cost.

The separable costs/remaining benefits method is similar to marginal/incremental methods with benefits providing a usually nonconstraining bound. Weighing against this advantage is the substantial disadvantage of complication and additional imprecision associated with quantification. As modified LRMC also incorporates benefit factors--although less directly than separable costs/remaining benefits--and since modified LRMC is not associated with significant amounts of additional complication and imprecision, the modified LRMC method is selected as the preferred combination method.

2.5 Evaluation and Selection of Recommended Cost Allocation Method

The best methods from each of the three generic cost allocation methods (cost-based, value of service, combination) are evaluated in this section. The candidate methods are: LRMC, user benefit/value of service, and modified LRMC. The evaluation and

the period being examined; 2) allocate the incremental part according to users' proportional shares of benefits; and 3) allocate the non-incremental part according to the ratio of users' value of service proportions.* This method is generally reflective of users' ability to pay.

A final value of service consideration, although not explicitly a value of service method, involves an aspect of the separate facilities method described in Section 2.2.1. The cost of providing a separate minimum requirements system for general aviation, which is the least sophisticated user in terms of technical needs, can be used as a lower bound for cost allocation to general aviation users in the present system. This matter is addressed more fully in another report of this cost allocation study (Reference 18).

2.3.2 Comparison and Evaluation

In this section, value of service methods are compared, and a preferred method is selected based on the evaluation criteria of Section 2.1.1. The three methods being compared are: price discrimination, average benefits, and user benefits/value of service.

Of the three value of service methods, the average benefits method is the least suitable because value of service is related to price elasticity of demand which is more directly a function of marginal benefits than of average benefits. There is no clear-cut advantage of either the user benefits/value of service method or the price discrimination method. Nevertheless, the user benefits/value of service method is selected as the preferred value of service method for two reasons. The first reason is based on the equity and efficiency problems posed by the price discrimination method which mimics the possibly undesirable actions of a profit-maximizing discriminating monopolist. Secondly, the best features of the price discrimination method are contained in the combined methods which are discussed in Section 2.4.

2.4 Combination Cost Allocation Methods

The combination methods offer the advantage of considering both supply and demand factors. These methods perform initial allocations of variable costs based on marginal/incremental methods and then allocate any remaining costs based on value of service methods.

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* The value of service proportions are assumed to be linearly related to users' total expenditures in the airport and airway environment.

2.3.1 Description of Methods

The primary value of service methods considered in this cost allocation study include: price discrimination, average benefits, and user benefits/value of service.

The price discrimination method allocates costs based on users' propensity and ability to pay. This method simulates the actions of a profit-maximizing discriminating monopolist, except that the method is constrained to recover no more than total costs. This process is similar to charging what the market will bear. It basically involves charging those with the least elastic demand more and those with the most elastic demand less. The three versions of price discrimination, which are dealt with in many economics texts, are based on: 1) dividing users into favored and disfavored groups based on each group's price elasticity of demand, 2) charging users according to general amount of use categories, and 3) charging users based on the value of each additional unit of consumption to each user group. While price discrimination has a bad connotation, it is quite acceptable under certain circumstances.*

The average benefits method allocates costs in proportion to the product of users' average benefits times their respective facilities usage rates. Average benefits can be calculated using econometrically derived values of price elasticity of demand or on opportunity costs associated with hypothesized avoidance of airport and airway system usage.

The user benefits/value of service method attempts to distribute the costs of joint and common use facilities proportionally to the utility received by users' participating in airport and airway activities. After assigning clearly-allocable costs, the user benefits/value of service method consists of three basic steps: 1) partition the remaining cost base into incremental and non-incremental portions relative to costs incurred at the start of

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* Price discrimination is acceptable except when certain conditions are violated. Discrimination based on personal, locational, or other factors prohibited under law is unacceptable. Price discrimination is also unacceptable if it results in any user paying less than marginal costs minus economically justified external subsidy. A final limitation is that no group should pay more than the cost of being served alone in a dedicated system at the same level of service being provided in the common system.

2.2.3 Comparison and Evaluation

In this section, cost-based allocation methods are compared and a preferred method is selected by applying the evaluation criteria of Section 2.1.1. In general, marginal/incremental cost methods are preferred to average cost methods. The main reason, which is discussed in detail in Appendix A, is that when the average cost method is used and average cost exceeds marginal cost--this is the usual case for the airport and airway system--some activities, which would be undertaken when priced at marginal costs and which would have net positive benefits, would be suppressed. Under usual circumstances, cost allocation based on marginal cost will more closely approach the theoretical efficiency of a competitive marketplace than will cost allocation based on average cost. Furthermore, use of marginal/incremental cost methods ensures that cross-subsidy and other undesirable and inequitable conditions will not exist.

Thus, the choice of a preferred cost-based method is limited to marginal/incremental methods. SRMC can be eliminated from consideration because of its substantial practical problems which include: high administrative costs, instability, and measurement difficulties. The separate facilities method is eliminated for similar reasons, as much uncertainty is associated with the determination of configurations and costs of separate systems.* Of the remaining methods, long-run cost responsibility uses measures that are significantly more weakly related to costs than are the measures used in the other methods. The final choice then reduces to the similar LRMC and LRIC methods. These methods differ only in that LRIC allocates any residual costs remaining after basic costs are assigned in proportion to facilities usage rates rather than in proportion to marginal costs. This former residual-allocation technique is less cost-related than the latter. Thus, LRMC best satisfies the evaluation criteria and is recommended as the preferred cost-based method.

2.3 Value of Service Allocation Methods

After assigning clearly-allocable costs, value of service methods allocate remaining costs as a function of users' respective values of service associated with airport and airway activities. These methods are based primarily on demand factors to the exclusion of supply factors.

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* However, useful value of service concepts, which are discussed later, are related to this method.

The separate facilities cost method examines the fundamental requirements of users as a basis for allocating costs of a common system. The costs of creating completely separate and dedicated systems are estimated for each of three user classes: general aviation, military, and air carrier. Common and joint costs are then allocated in proportion to these separate facilities costs.

The long-run cost responsibility method avoids activity levels and benefits almost entirely in allocating costs among users. In this method, costs are allocated on the basis of the technical requirements of each user. This is accomplished by assigning incremental costs to homogeneous aircraft classes, and allocating costs to user groups based on the number and type of aircraft in their fleets. Non-incremental costs are spread among all aircraft classes.

2.2.2 Average Cost Methods

Average cost methods distribute total costs to users in proportion to their respective average costs per unit of use and the amount of usage generated by each group. When using average costs for the airport and airway system, a choice exists for defining output units: either simple number of operations or some weighted function indicative of the resouce requirements for each type of operation.

The average cost method using simple number of operations is termed units of use. This method implicitly assumes that cost per unit of use is constant across all user categories. For example, it assumes that, for a particular type of operation, a general aviation user imposes the same costs on a given facility as an air carrier user does. The units of use method is implemented by allocating costs as a percentage of total system units of use consumed by each user group.

The method using weighted output measures is termed measures of use. This method relaxes the restrictive assumptions of units of use by developing weighting (or efficiency) coefficients that reflect the extent to which different types of activities impose different cost burdens on the system. For most effective use, these factors should be developed for all significant activity types and not for just a few key areas. Weighting factors can be developed through judgmental techniques or through regression analysis. Once output weighting coefficients have been developed, this method is applied in a manner analogous to units of use.

2.2 Cost-Based Allocation Methods

Cost-based allocation methods distribute total costs as a function of costs imposed by users on the system. The two categories of cost-based allocation techniques are marginal/incremental cost methods and average cost methods.

2.2.1 Marginal/Incremental Cost Methods

Marginal/incremental cost techniques refer to allocations based on the additional costs imposed on the system by some amount of additional use. Marginal costs are costs incurred by increasing output by exactly one unit, which is as close to an infinitesimally small change as is possible. Incremental costs are costs incurred by increasing output by some specified quantity. In mathematical terms, marginal cost refers to derivatives $\left(\frac{\partial Y}{\partial X}\right)$, and incremental cost refers to variations $\left(\frac{\Delta Y}{\Delta X}\right)$. Both econometric and engineering relationships can be developed to describe marginal/incremental cost relationships. Variants of marginal/incremental cost allocation methods include: short-run marginal cost (SRMC), long-run marginal cost (LRMC), long-run incremental cost (LRIC), separate facilities cost, and long-run cost responsibility.

The short-run marginal cost method allocates costs to users in proportion to the product of their respective short-run marginal costs times their activity quantities. These marginal costs are defined as short-run changes in the variable costs associated with serving one more user with the existing system. This method does not consider sunk costs (and associated depreciation) or current facilities and equipment (F&E) investment costs. However, it does consider change in value of capital equipment associated with additional use.

The long-run marginal cost method is similar to the SRMC method. The primary difference is that LRMC is estimated based on a longer time period. Hence, more cost elements are considered variable in the LRMC method. As is the case for SRMC, the marginal cost attributable to each type of use is calculated, and each group is assessed charges that are equal to the unit marginal costs multiplied by the total units of each type consumed by the users in the group. As applied here and in the 1973 Cost Allocation Study, any funding deficit is assigned to users in the form of surcharges proportional to LRMC.

The long-run incremental cost method is similar to the LRMC method. In the LRIC technique, costs are categorized as being either avoidable or unavoidable. Each user group is assigned its avoidable costs plus a share of the unavoidable costs that is proportional to that group's use of a given facility.

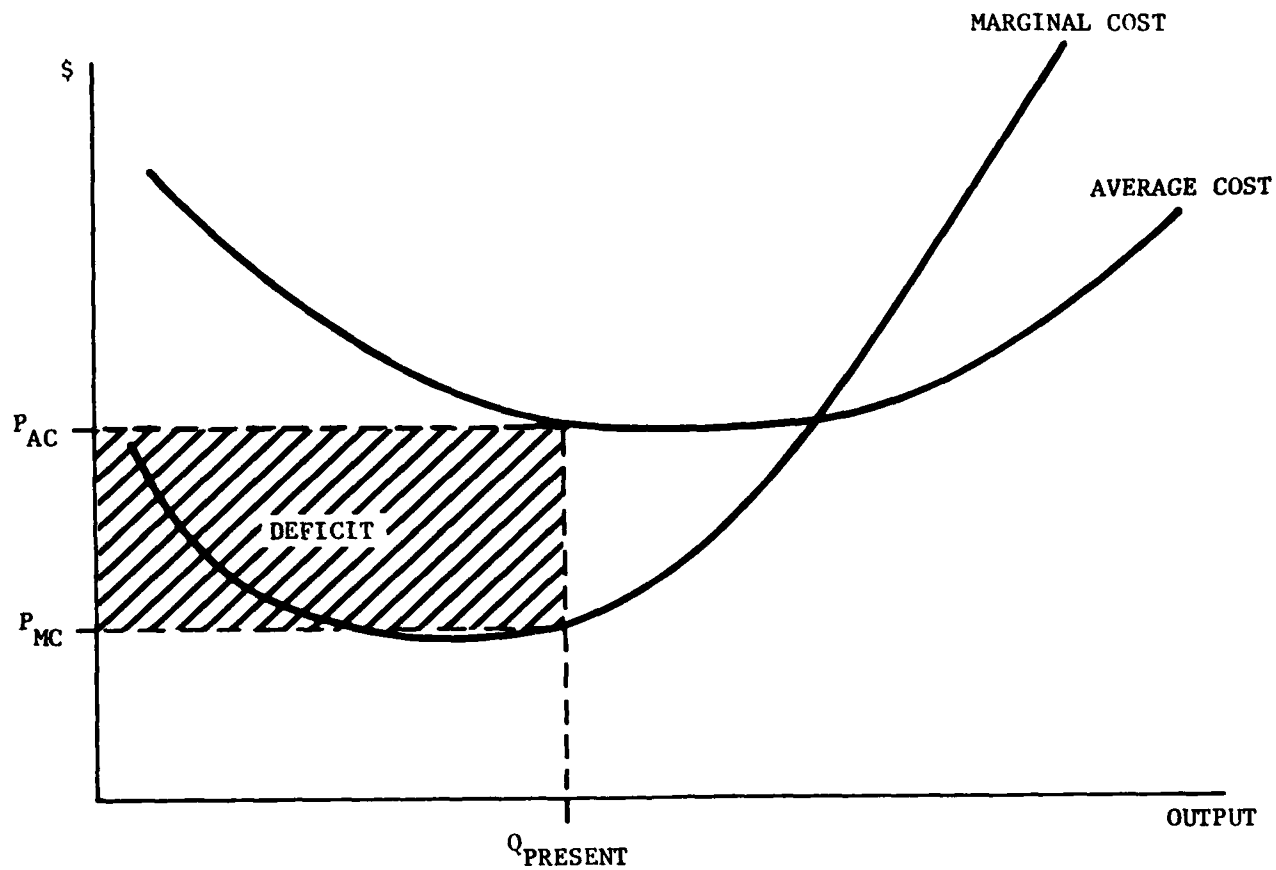

FIGURE 2-1
DEFICIT ASSOCIATED WITH MARGINAL COST PRICING

Common costs are associated with output elements that are produced together. These elements or products may be either goods or services. The key factor is that common costs are associated with output elements that can be produced in variable proportions, i.e., the balance of the product mix can be changed.* Common costs should be allocated in proportion to users' respective marginal costs.

Joint costs, like common costs, are associated with output elements that are produced together. Unlike the case for common costs, joint elements must be produced in effectively fixed and unchangeable proportions.** For the purposes of cost allocation, jointness refers not only to physical fixity of product mix, but also to fixity arising from economic considerations. Joint costs should be allocated as an inverse function of demand intensity or elasticity of demand. In allocating joint costs according to demand or value of service characteristics, marginal opportunity costs are implicitly defined. In this way, common and joint costs can be considered consistently.

If these pricing prescriptions are followed, a deficit will usually result when operating in a region of economies of scale. As illustrated in Figure 2-1, marginal costs will be less than average costs under these conditions. The resulting deficit can be covered either through subsidy or through price discrimination. The application of price discrimination is approximately equivalent to recognizing that this residual acts like a jointly produced set of outputs. The proper limits on this form of price discrimination are discussed later in this report.

2.1.3 Peak Capacity Costs

The time-of-dav distribution of demand for services is a factor that is relevant to nearly all cost allocation methods. Cost, and probably value of service, of operating in peak periods is greater than in off-peak periods. This increased cost arises from the need to invest in additional facilities and staff for serving the peaks. Thus, user temporal patterns with regard to peaking is a potentially important disaggregating factor. Equity and economic efficiency are usually enhanced when peak charges are set higher than off-peak charges. This matter is investigated more fully for possible use in this cost allocation study in Appendix B.

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* Controller staffing costs tend to be common costs since they vary as a function of number and mix of IFR and VFR operations.

** Examples of joint costs from air transportation occur where a portion of the infrastructure which is required to serve one class of user also serves the needs of other classes of users. In this situation, even if the latter classes ceased operations, the entire joint portion of the infrastructure would remain to serve the first class of users.

prices. Definition of these groups is usually based on factors such as ability or income/wealth class. In a basically competitive marketplace, or one that mimics such, economic efficiency or some form of equity will be approached.

A third criterion is ability to pay. In an economically optimal cost allocation system some current users may be hard pressed or unable to pay their share. This usually indicates that these users should be making less intensive (or no) use of some resources. Only in cases where external benefits accrue or where certain users are deemed deserving of special privileges and treatment--for instance, to counteract some other imbalance or simply because society, for some reason, has decided to favor them--should ability to pay be allowed to distort the eventual allocation of costs.

A final criterion is minimization of deficit or completeness of cost recovery. This criterion is dealt with in this study by structuring each alternative method to provide for full cost recovery except to the extent that justified subsidy exists (Reference 11).

In summary, ability to pay, as well as some aspects of equity, may be in conflict with economic efficiency. Areas of conflict among these criteria are usually related to income or wealth distribution. In general, for the aviation context, these problems are most appropriately and effectively resolved by means other than alterations in airport and airway cost allocation formulae.* Thus, the primary direction of this evaluation is based on economically efficient cost allocation constrained by full cost recovery to the extent possible, and tempered by other criteria where necessary.

2.1.2 Types of Cost and Their Treatment

Economists classify costs into three general categories: clearly-allocable (or clearly-assignable) costs, common costs, and joint costs. These cost categories and their recommended theoretical treatment for cost allocation are described below.

Clearly-allocable costs are those directly attributable to the production of a single output quantity for a given users. These costs should be charged directly to the responsible parties.

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* In particular, some problems in this area are related to cost recovery or other factors that are outside the scope of this cost allocation study. For instance, sudden increases in user charges for those underpaying in the past are probably undesirable. As these users invested in facilities and equipment based on an earlier set of rules, they should be afforded a gradual transition period to adjust to the new equilibrium.

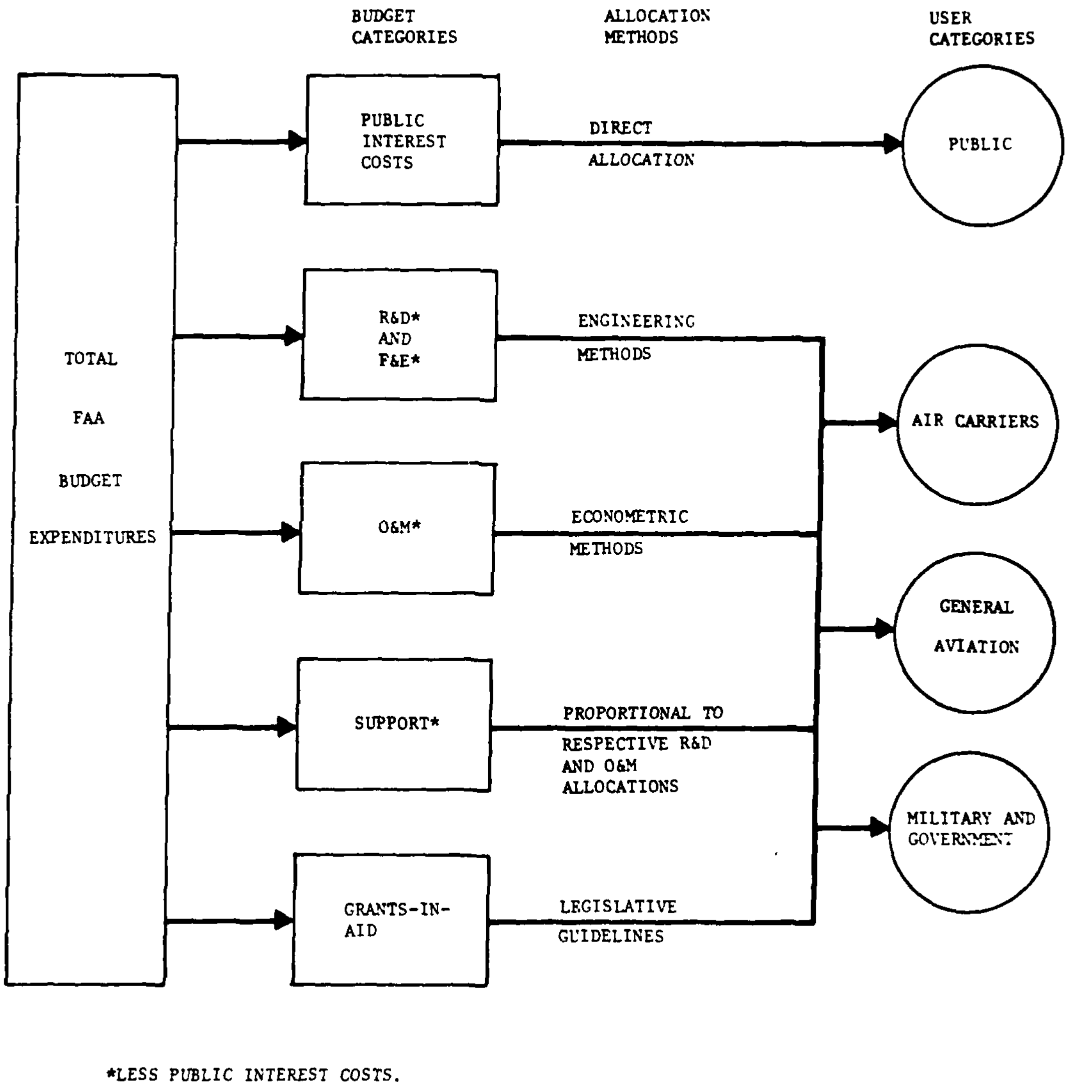

FIGURE 3-1
COST ALLOCATION PROCEDURE

TABLE 3-2

FAA COSTS ATTRIBUTABLE TO PUBLIC INTEREST

(FY76 CONSTANT DOLLARS IN MILLIONS)

FAA BUDGET CATEGORY	BENEFIT CATEGORY*	FY77	78	79	80	81	82	83	84	85	86
R&D	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
F&E											
Towers	4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
O&M											
Centers	3	51.7	52.3	51.2	51.2	51.9	54.0	55.3	55.2	56.4	57.5
Towers	3,4	37.9	38.1	39.2	39.6	39.6	39.7	39.9	40.4	40.7	40.8
FSS	2	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Other	3	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Support											
I&M	2,3,4	36.1	37.1	38.3	39.3	40.1	41.6	43.2	44.8	46.4	47.9
Adm Flt Std	1	142.3	150.7	154.7	158.6	163.4	168.5	173.1	176.8	181.7	186.6
Adm Med	1	8.5	9.1	9.3	9.5	9.8	10.5	10.9	11.2	11.5	11.9
Ap Admin	1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Cent Trng	1,4	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
Dir, S&S	1,4	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2
F,E&D	1	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3
NAT CAP AP	1	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4
TOTAL		395.4	406.1	411.6	417.1	423.7	433.1	441.2	447.2	455.5	463.6

*Benefit Category Key:
1 - Safety, medicine, environment, and directly recoverable
2 - Nonaviation use of weather services
3 - Military requirements
4 - Small community subsidy

FAA budget categories are first disaggregated into a set of program elements. At this level, the split of expenditures between users is often defined by the nature of the program element itself. And, in many cases, objective measures can be used to guide the apportionment of user responsibility.

Then, for each program element, a percentage share is assigned to each user based on what is judged to be the value (based on the above criteria) of any expenditure on that item relative to the other users. When all the elements are thus apportioned, the elements are grouped into respective budget categories. The aggregate percentage shares of air carrier, general aviation and military are then normalized for each of the ten years of the planning period. Since the percentage allocation of all categories remains fairly stable over the time period, only a weighted average for each category is used to allocate costs throughout the planning period. A list of the detailed program elements and the portions assigned to each of the user groups are graphically presented in Appendix E. The resulting percentage splits between the users for each of the major R&D and F&E categories are summarized in Table 3-3.

3.3 Operations and Maintenance (O&M) Costs

In general, O&M costs are directly influenced by levels of aircraft activity in the air traffic control system. Staff salaries comprise the greatest part of the cost to operate and maintain FAA control facilities. Staffing requirements are, in turn, determined by FAA staffing equations as a direct function of air traffic activity. Maintenance requirements vary with the level of existing capital inventory which, in the long run, is affected by user demand. One would expect, therefore, that long-run marginal cost techniques would be applicable for allocation of this category of costs.

The availability of a more recent 1974 data base permitted Administrative Sciences Corporation (ASC) to perform a technical review and an update of the O&M long-run marginal cost equations formulated by the 1973 Cost Allocation Study and incorporated in the ASC model. A number of technical difficulties atributable to collinearity in the original 1973 study prompted the reestimation of en route O&M long-run marginal costs. Reestimation of terminal and FSS categories were determined to be insufficiently different to warrant changing. The particulars of the en route reestimation are discussed in Appendix C.

TABLE 3-3

PERCENTAGE ALLOCATION OF CAPITAL EXPENDITURES

FAA BUDGET CATEGORY	% ALLOCATION		
	AIR CARRIER	GENERAL AVIATION	MILITARY
Research and Development	64	25	11
Facilities and Equipment			
En Route Centers	72	10	18
Terminal	54	33	13
Flight Service Stations	5	95	0
Navigation Aids	54	33	13
Other	67	33	0

Total cost equations generally take the form

$$C = a_o + \sum_i a_i * USE_i + e_o \qquad (1)$$

where

C	=	O&M costs at a particular facility
a_o	=	intercept of regression analysis representing residual joint costs
a_i	=	marginal cost coefficient for user i
USE_i	=	use of the facility by user i
e_o	=	error term

Using techniques of regression analysis, the marginal costs coefficients are then estimated from an appropriate cross-sectional data base (see Appendix C for an example).

A user's share of the total cost in a future market is merely the product of his marginal cost coefficient and his forecast activity level which can be represented as:

$$MC_i = a_i * USE_i \qquad (2)$$

However, in a system of decreasing average costs with increased activity levels, such as in the Airport and Airway System, marginal costing will not fully recover total costs. If we let S_i represent the porportion of the residual allocated to user i, then the total cost equation (1) becomes:

$$C = \Sigma (MC_i + a_o * S_i) + e_o \qquad (3)$$

With reference to the discussion in Section 2, the residual is allocated to each user in proportion to the product of his marginal cost and the inverse of his price elasticity of demand (e_i). Therefore,

$$S_i = \frac{\frac{MC_i}{e_i}}{\sum_j \left(\frac{MC_j}{e_j}\right)} \tag{4}$$

A summary of the O&M marginal cost coefficients and elasticities of demand are presented in Tables 3-4 and 3-5. The derivation of the price elasticities is found in Appendix D.

3.4 Grants-in-Aid

The Grants-in-Aid program was established by the Airport and Airway Development Act of 1970. Subsequent amendments, the latest enacted in 1976 as Public Law 94-353, direct how program funds are to be spent on air carrier and general aviation facility improvements. Therefore, it is reasonable to allocate these funds as prescribed by the legislation. Because their level of activity is projected to remain constant throughout the planning period, military and government users are not expected to impose any further requirements or to receive additional benefits from further civil airport improvements. As a result, they are assigned no cost responsibility for Grants-in-Aid funding.

3.5 Support Costs

Inasmuch as support costs are composed of qualitatively different elements, they are allocated in direct proportion to the programs they support. Specifically, the elements relating to R&D are allocated to the users in the same manner as R&D; those relating to the Airport Program are allocated the same as Grants-in-Aid; those relating to Installation and Material Services are allocated the same as Traffic Control and Maintenance and so forth. These categorical relationships are presented in Table 3-6.

3.6 Summary

The composite set of allocation rules which follow from the previous discussions are summarized in Table 3-7.

TABLE 3-4

O&M LONG-RUN MARGINAL COST COEFFICIENTS

FAA BUDGET CATEGORY	COEFFICIENTS AIR CARRIER	GENERAL AVIATION	MILITARY	ACTIVITY MEASURE
OPERATIONS AND MAINTENANCE				
EN ROUTE CENTERS	13.83	9.96	17.60	total IFR aircraft handled
TERMINAL CENTERS	10.04	1.88	6.47	total tower operations
FLIGHT SERVICE STATIONS	1.51	1.51	1.51	total no. of pilot briefs
	1.12	1.12	1.12	total no. of flight plans filed
	1.72	1.72	1.72	total no. of aircraft contacts
OTHER FACILITIES		(see footnote 4)		

NOTE:

1. Forecasts of activity measures are extracted from Aviation Forecasts Fiscal Year 1977-1988, September 1976.

2. Total number of pilot briefs and flight plans at flight service stations are distributed over the user categories as follows (based on 1973 Cost Allocation Study):

	Air Carrier	General Aviation	Military
Pilot briefs:	4.0%	87.0%	9.0%
Flight plans:	11.4%	67.0%	21.6%

3. LRMC coefficients are expressed in FY76 dollars.

4. Costs associated with the "Other" category of facilities are allocated in proportion to the total user allocations of en route, terminal and FSS costs.

TABLE 3-5

O&M PRICE ELASTICITIES* OF DEMAND

AVIATION USER	PRICE ELASTICITY
Air Carrier	-1
General Aviation	-2
Military	-1

*Price elasticities of demand measure the percent change in demand for a service with respect to a percent change in the price of that service. Details are presented in Appendix F.

TABLE 3-6

FUNCTIONAL RELATIONSHIP OF SUPPORT COSTS TO OTHER BUDGET CATEGORIES

SUPPORT COST CATEGORY	BUDGET CATEGORY SUPPORTED
I&M	O&M
ADM FLT STDS	*
ADM MED	*
DEV DIR	R&D
ARPT ADMIN	GRANTS-IN-AID
CENT TRNG & DIR, S&S	
O&M	O&M
I&M	O&M
FLT STDS	*
MED	*
DEV DIR	R&D
ARPT ADMIN	GRANTS-IN-AID

*Public benefit and directly recoverable programs allocated in full to the public sector.

TABLE 3-7

PROCEDURAL SUMMARY FOR COST ALLOCATION
(AFTER REMOVAL OF PUBLIC INTEREST COSTS)

FAA BUDGET CATEGORY	ALLOCATION METHOD
R&D F&E (ALL CATEGORIES) O&M	PROPORTIONAL TO AGGREGATE PERCENTAGE SHARES AS DETERMINED BY ENGINEERING ESTIMATES
CENTERS TOWERS FSS	PROPORTIONAL TO LONG-RUN MARGINAL COSTS. RESIDUAL JOINT COSTS ALLOCATED PROPORTIONAL TO INVERSE OF PRICE ELASTICITIES OF DEMAND.
OTHER	PROPORTIONAL TO CUMULATIVE CENTER, TOWER, & FSS ALLOCATIONS
SUPPORT	
I&M	PROPORTIONAL TO TOTAL O&M ALLOCATION
DEV DIR	PROPORTIONAL TO TOTAL R&D ALLOCATION
ADMIN ARPTS	PROPORTIONAL TO GRANTS-IN-AID ALLOCATION
CEN TRNG DIR, S&S	COMPONENTS ALLOCATED PROPORTIONAL TO RESPECTIVE O&M, R&D AND GRANTS-IN-AID ALLOCATIONS
GRANTS-IN-AID	AIR CARRIER AIRPORT GRANTS ALLOCATED TO AIR CARRIER. GA AIRPORT GRANTS ALLOCATED TO GA. PLANNING GRANTS ALLOCATED PROPORTIONAL TO RESPECTIVE AIRPORT GRANTS.

4. ADJUSTMENTS TO USER ALLOCATIONS

It is necessary to adjust the cost allocations for government-owned civil aircraft operations and nonrevenue air carrier flights normally counted in general aviation statistics. It is estimated that four percent of general aviation operations reported by the FAA are due to government aircraft activity (Reference 2). The general aviation allocation is consequently reduced by four percent and added to the composite military and government allocation.

Based on FY76 Civil Aeronautics Board data (Reference 1), nonrevenue air carrier flights comprise approximately one percent of total air carrier activity. Therefore, costs incurred as the result of nonrevenue air carrier flights are estimated at one percent of the total air carrier cost. As a result, the general aviation allocation is reduced accordingly and added to the air carrier allocation. These adjustments are shown in the detailed allocation tables of Appendix F.

5. RESULTS OF USER COST ALLOCATION

Two sets of Airport and Airway System Costs are developed in Reference 10. The baseline set is a forecast of costs that might be incurred if historical relationships between expenditures and user activity are continued into the future. The alternative cost base predicts the airport and airway costs that will be experienced if planned UG3RD enhancements are incorporated in the system. The results of allocating the cost bases in accordance with the rules formulated in Section 3 are summarized in Table 5-1 (FY76 constant dollars) and Table 5-2 (current dollars). Detailed allocations are located in Appendix F.

The percent distribution of Federal Aviation Administration (FAA) costs allocated to users of the airport and airway system fluctuates very little throughout the period FY77 to FY86:

Public Interest	:	16-17%
Air Carriers	:	48-50%
General Aviation	:	24-27%
Military and Government	:	8-10%

Furthermore, this distribution remains relatively constant irrespective of whether the baseline or the alternative cost scenario is used.

TABLE 5-1

COST ALLOCATION SUMMARY
FY76 CONSTANT DOLLARS IN MILLIONS

	FY77	78	79	80	81	82	83	84	85	86
BASELINE COSTS										
TOTAL	2410.1	2477.0	2581.2	2651.3	2696.5	2709.5	2750.3	2807.9	2853.2	2892.4
PUBLIC & OTHER	395.4	406.1	411.6	417.1	423.7	433.1	441.2	447.2	455.5	463.6
AIR CARRIER	1216.5	1245.3	1280.9	1312.2	1315.0	1300.9	1320.7	1345.1	1370.7	1396.0
GENERAL AVIATION	567.6	593.9	650.1	678.0	713.9	738.0	749.1	773.8	783.5	788.1
MILITARY & GOVERNMENT	230.5	231.7	238.7	244.1	244.0	237.4	239.2	241.8	243.5	244.7
ALTERNATIVE COSTS										
TOTAL	2410.1	2524.2	2612.2	2661.2	2682.2	2701.9	2702.5	2718.2	2692.8	2678.9
PUBLIC & OTHER	395.4	406.1	411.6	417.1	423.7	433.1	441.2	447.2	455.5	463.6
AIR CARRIER	1216.5	1254.1	1289.4	1299.3	1289.0	1287.2	1286.3	1296.3	1287.6	1275.4
GENERAL AVIATION	567.6	628.9	670.0	702.9	732.3	748.8	746.4	748.5	729.6	727.5
MILITARY & GOVERNMENT	230.5	235.1	241.2	241.9	237.2	232.8	228.6	226.2	220.1	212.3

TABLE 5-2

COST ALLOCATION SUMMARY
CURRENT DOLLARS IN MILLIONS

	FY77	78	79	80	81	82	83	84	85	86
BASELINE COSTS										
TOTAL	2587.1	2823.2	3116.8	3389.9	3647.4	3863.1	4125.8	4426.8	4752.7	5073.2
PUBLIC & OTHER	426.2	464.5	497.6	532.6	572.3	617.6	663.1	708.2	762.4	817.1
AIR CARRIER	1302.9	1417.5	1548.4	1683.3	1785.7	1861.6	1986.4	2123.8	2285.8	2448.7
GENERAL AVIATION	609.9	676.8	782.9	862.9	960.5	1046.6	1118.4	1214.3	1299.6	1378.9
MILITARY & GOVERNMENT	248.1	264.3	287.8	311.1	328.8	337.4	357.9	380.5	404.9	428.5
ALTERNATIVE COSTS										
TOTAL	2587.1	2875.1	3152.8	3398.1	3622.5	3846.1	4044.1	4272.8	4473.3	4685.8
PUBLIC & OTHER	426.2	464.5	497.6	532.6	572.3	617.6	663.1	708.2	762.4	817.1
AIR CARRIER	1302.9	1427.3	1558.2	1664.8	1748.4	1839.3	1929.4	2038.9	2139.0	2229.6
GENERAL AVIATION	609.9	715.2	806.3	893.0	982.9	1059.2	1111.0	1171.4	1208.1	1269.2
MILITARY & GOVERNMENT	248.1	268.0	290.7	307.7	319.0	330.1	340.6	354.3	363.8	369.9

There is reason to believe the true value may lie a good deal closer to the high than the low end of that range. In the 1973 Cost Allocation Study's Working Paper No. 5, Measures of Use, En Route O&M unit costs were postulated to be inversely proportional to the average speeds of different user group aircraft. General aviation's average speed being lower than that of either air carrier or military, the cost of a GA IFR Aircraft Handled was therefore judged in that document to be higher than the other user groups, not seventy or eighty percent lower as the regression results suggested.

A second reason for the reestimation decision emerged when the en route cost function was estimated (using the original Cost Allocation Study data) by the method of Ridge Analysis, or Ridge Regression.[4] Those results indicated that the GA cost coefficient had been underestimated and the AC coefficient overestimated. The difficulty appears to have been collinearity between the AC and GA activity variables.

Data Base for Reestimation

Another motivation for the decision to generate new en route marginal cost estimates was the ready availability of a comparable and more current (1974) data base.[5] Those data are displayed in Table C-1. The following is a brief description of how they were developed.

Operations Costs - The number of staff positions at each center multiplied by the actual FY76 center traffic control "cost conversion factor" of $25,748.

Maintenance Costs - #1 - The capital stock at each center, computed from the FAA's facility and equipment inventory and price list and expressed in 1974 dollars, divided by the Center maintenance capital/labor ratio of $177,460 (also in FY74 dollars), and multiplied by the actual FY76 maintenance cost conversion factor of $28,875. (Note that division of the capital stock estimate by a capital to labor ratio produces a "pure"

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[4] The seminal articles on this technique, which is an iterative procedure designed to counter the effects of multicollinearity (high intercorrelation between independent variables) are A.E. Hoerl and R.W. Kennard, "Ridge Regression: Biased Estimation for Nonorthogonal Problems" and "Ridge Regression: Applications to Nonorthogonal Problems," Technometrics, Vol. 12, No. 1, (February 1970), pp. 55-82. A summary of the procedure appears as Appendix A to An Economic Analysis of En Route and Terminal Air Traffic Control, Report No. FAA-AVP-77-1, June 1976.

[5] That data was assembled in connection with the work described in Report No. FAA-AVP-77-1, cited in the preceding footnote.

APPENDIX C

REESTIMATION OF EN ROUTE O&M MARGINAL COSTS

En Route operations and maintenance costs account for roughly one-half of all Traffic Control costs, and about one-fourth of total expenditures from the General Fund. Accordingly, obtaining accurate estimates of the long run marginal costs applicable to en route activity, which are then used for allocating that portion of the cost base, is a matter of considerable importance. Estimates developed in the 1973 DOT Airport and Airway Cost Allocation Study,[1] with their respective t-values shown in parentheses, were:

AC	GA	MIL
$10.31	$1.38	$9.19
(5.15)	(0.25)	(3.42)

These costs are expressed in a 1971 price base, and the activity measures to which they relate are IFR Aircraft Handled.

Conventional interpretation of the very low t-value associated with GA activity mav take one of two forms.[2] Either GA activity has no bearing on en route O&M costs and the true value of the coefficient is in fact zero; or the available data did not provide an adequate basis for measuring GA's impact on costs. For reasons to be discussed below, the present study considered the latter interpretation to be the correct one, and a decision was therefore made to reestimate en route O&M marginal costs for purposes of cost allocation.

The lowest reasonable value for the GA marginal cost is, of course, zero. Based on the above t-value of 0.25, which implies a standard error of 5.52, the range of likely values (the confidence interval) extends beyond $12.00; i.e., the original estimate plus twice its standard error.[3]

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[1] See Airport and Airway Cost Allocation Study, Part I Report Technical Supplement, Nov. 1973, p. 101, Regression No. ER-O&M-2.

[2] The characterization "very low" is admittedly subjective. A widely adopted rule-of-thumb is that a regression coefficient is well estimated if its t-value is at least 2.0. From the point of view of formal tests of hypotheses, the critical t-values in this case (with 19-5 = 14 degrees of freedom) are 1.761 for a one-tailed test and 2.145 for a two-tailed test, each at the .05 significance level.

[3] Multiplying the standard error by two is consistent with the same rule-of-thumb discussed in the preceding footnote.

surcharges that result in cost allocation on an individual operator basis and not on a user-group basis. As such, this factor would be best included in the cost recovery phase of this analysis and not in the user-group cost allocation phase. While such a peaking-surcharge program would entail some administrative burden, its implementation would flatten peaks thereby effectively increasing daily and annual capacity, would result in more equitable charges, and would help ensure an optimal facilities use pattern.

not particularly sensitive to definition of the peak period or any other inputs.

While these results were not originally expected, they are explainable. At airports having a high percentage of GA activity (e.g., Baton Rouge, Fort Wayne), air carrier operations tended to be spurious and were often scheduled as non-primary tags ends on multi-stop flights. Thus, no significant peaking differences should have been expected at this class of airport. At airports that have a large percentage of air carrier operations (e.g., O'Hare, JFK), the GA population is likely to consist of a large percentage of larger turbine-powered aircraft that are well-instrumented. Thus, these GA users would behave similarly to air carriers, and no significant differences should be found.

A good explanation of why significant differences were not present at the mid-range of airports was not found. Perhaps the underlying reason is that crowding, delays, and lack of peak-period pricing differentials resulted in conditions that were not sufficient to nudge GA operators to off-peak times. Perhaps no significant differences were found because those GA users with a propensity to avoid peaks have moved to the off-peak days that were not examined. Finally, perhaps weather conditions for the days studied were not adverse enough to accentuate the differences between IFR-equipped aircraft and non-IFR-equipped aircraft.

While significant differences in peak-period behavior were not detected among user types, this does not necessarily mean that differences do not actually exist. However, in light of this evidence, any differences that do exist are probably small. If GA users were divided into finer categories (e.g., turbine vs. piston, IFR-equipped vs. non-equipped, small vs. large), greater differences might have been detected. As mentioned earlier, if the analysis examined daily as well as hourly data, significant differences might have been found. Finally, while the set of airports examined was sufficient in size and mix to draw these conclusions, some airports might, nonetheless, exhibit this diversity in behavior.

Based on this analysis, explicit inclusion of peak-period pricing differentials among user groups is not recommended. However, the hypothesized effect might really exist and can be subjectively included by decision makers.

While no significant differences were found among user groups, significant differences were found between peak and off-peak periods. This would suggest the desirability of using temporal

TABLE B-1
PEAK PERIOD ANALYSIS

Airport	$\bar{P}_{off\text{-}peak}$*	$\bar{P}_{peak}$*	t**
Jacksonville, FL	.354	.357	.014
Nashville, TN	.462	.575	.443
Dothan, AL	.312	.134	-.608
Mobile, AL	.462	.807	1.720
Raleigh, NC	.730	.878	1.348
Savannah, GA	.750	.850	.065
Chicago, IL (O'Hare)	.078	.129	1.796
Philadelphia, PA	.109	.187	1.070
Baton Rouge, LA	.670	.956	.966
Newark, NJ	.145	.171	.316
Fort Wayne, IN	.715	.911	.975
New York, NY (La Guardia)	.183	.154	.284
Pittsburgh, PA	.181	.209	.460
Los Angeles, CA	.130	.178	1.138
Pensacola, FL	.681	.912	1.290
Harlingen, TX	.689	.832	.458
Santa Barbara, CA	.885	.915	.519
St. Louis, MO	.327	.385	.671
Boston, MA	.111	.154	.641
San Francisco, CA	.204	.161	.604
Miami, FL	.220	.238	.187
New York, NY (JFK)	.033	.017	.603
Washington, DC (National)	.184	.123	.462
Denver, CO	.327	.402	.907
Atlanta, GA	.111	.105	.197
Dallas-Fort Worth, TX	.068	.080	.316

* $\bar{P}_{off\text{-}peak}$ ≡ average % GA operations in off-peak hours

$\bar{P}_{peak}$ ≡ average % GA operations in peak hours

** $t^{95\%}_{crit}$ ≈ 1.7 - 1.8 for typical sample size

2. ANALYSIS OF AIRPORT AND AIRWAY PEAKING

Peak-period pricing differentials can be calculated by determining the extent to which each user group operates in the peaks. Statistical uncertainty would require conservatism in calculating these peak-period differentials. With this objective in mind, an analysis of peaking was conducted.

Time-of-day peaking characteristics were studied. Daily and seasonal peaking analyses could have been conducted also, but data availability and variability among facilities makes the task of drawing general conclusions far more difficult for these two categories. This analysis was conducted for airports only. Appropriate data for other types of airport and airways facilities was not available. Avoidance of this area is not critical because variability in peak-period usage among users is probably much greater for airports than for other types of facilities.

This study examined the differences in propensity to operate in peak periods between GA and non-GA users. Prior to this study, the analysts expected that GA users would have a lower propensity to operate in peak periods than would air carriers and other users. This was hypothesized because many GA users have great freedom to divert their operations to off-peak hours, and because less instrumentation and smaller size make conditions more difficult and hazardous for GA users operating in a crowded terminal environment.

At each airport studied, hourly operations counts were collected, and the percentages of GA operations in each period were calculated. The peak period was roughly defined as the busiest three hours, but this definition was varied slightly when necessary to reflect local conditions. The average percentage of GA operations in the peak period was compared to the average percentage of GA operations in the off-peak period for each airport. "t-statistics" were calculated to indicate the significance of these differences. The critical value of the t-statistic at a 95% confidence level for the typical sample sizes encountered ranged from approximately 1.7 to 1.8.

The results of this analysis are presented in Table B-1. Casual observations, not reported in this table, showed that the total operations per hour in the peak periods significantly exceeded the total operations per hour in the off-peak periods. However, no significant differences were noted between GA behavior in peak and off-peak periods: the proportion of GA operations to total operations was nearly constant throughout the day. Most of the differences found, while not statistically significant, were contrary to original expectations. Furthermore, the results were

APPENDIX B

PEAK-PERIOD PRICING

1. THEORY

Variation in facility usage rates with time of day is potentially an important factor in cost allocation. In the airport and airway system, recurring and relatively stable peaks are usually present. For capital intensive production (or production using other fixed resources such as may be the case with restrictive work rules), the marginal costs of peak-period operations are usually higher than the marginal costs of off-peak operations because the system operator must invest in additional fixed resources to serve the peaks.*

Since peak-period users impose additional identifiable costs on the system, it is appropriate from equity and efficiency considerations to charge them higher prices.** The allocative penalty from failing to institute peaking charges is greatest when demand is most price elastic and when users have the most flexibility to shift temporal operating patterns. When all users make use of the same type of facilities, the costs of making peak capacity available is directly allocable to peak-period users, and hence off-peak users should not be explicitly charged for capacity costs (i.e., off-peak capacity is a free item). Exceptions and modifications to this rule may be appropriate if institution of a marginal cost pricing system would result in moving additional users to off-peak periods, if a capacity buffer exists to account for uncertainty in demand, or if price discrimination is explicity being practiced. These modifications should be determined on a case by case basis.

This theory is directly applicable to the airport and airway situation. Theory relevant to the case where peak and off-peak users make use of different types of facilities is generally not applicable to this airport and airway cost allocation study. In this study, the peaking statistic of most interest is differential use made by each user group of the peak periods. While beyond the scope of this study, further equity and economic benefits can be achieved by actually basing the cost recovery system on peaking factors even if each user group has a similar division of peak and off-peak activities.

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* In addition, peak-period users often bear significant congestion costs.

** The relevant peak period is that for the system as a whole and not necessarily the peak for any particular user group.

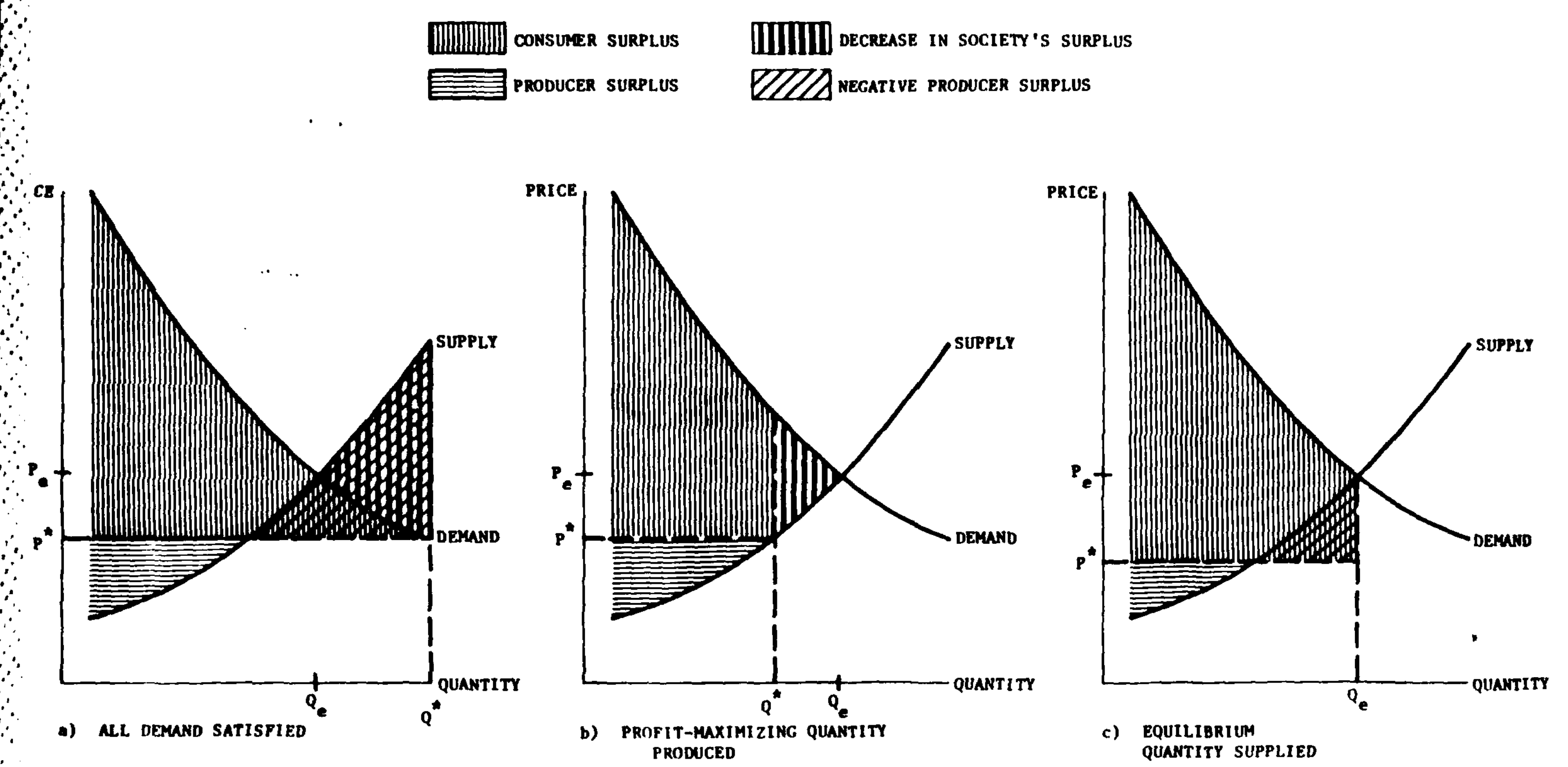

FIGURE A-4
CONSUMER AND PRODUCER SURPI
AT SUB-EQUILIBRIUM PRICES

price set above the equilibrium price might, in rare circumstances, not result in a decrease in society's surplus.

The previous discussion demonstrates that administered prices that diverge from marginal costs will almost always result in a decrease in society's surplus and, hence, a decrease in the public's general well-being. Of course in some cases, administrative costs and other market imperfections might result in some divergence being desirable. While analyses that are based solely on concepts of society's surplus fail to consider interpersonal comparisons, they are generally indicative of overall (net) welfare.

3. SUMMARY

Marginal cost pricing is an inherently efficient and equitable means of cost allocation. As with any method, modifications might be necessary to achieve compatibility with some goals, but the basic method provides producers with guides for determining economically optimal production rates and plant sizes. Further, marginal cost pricing precludes no use for which benefits exceed opportunity costs. This allows for maximization of public well-being which is particularly important in a Government regulated and operated system such as the airport and airway system.

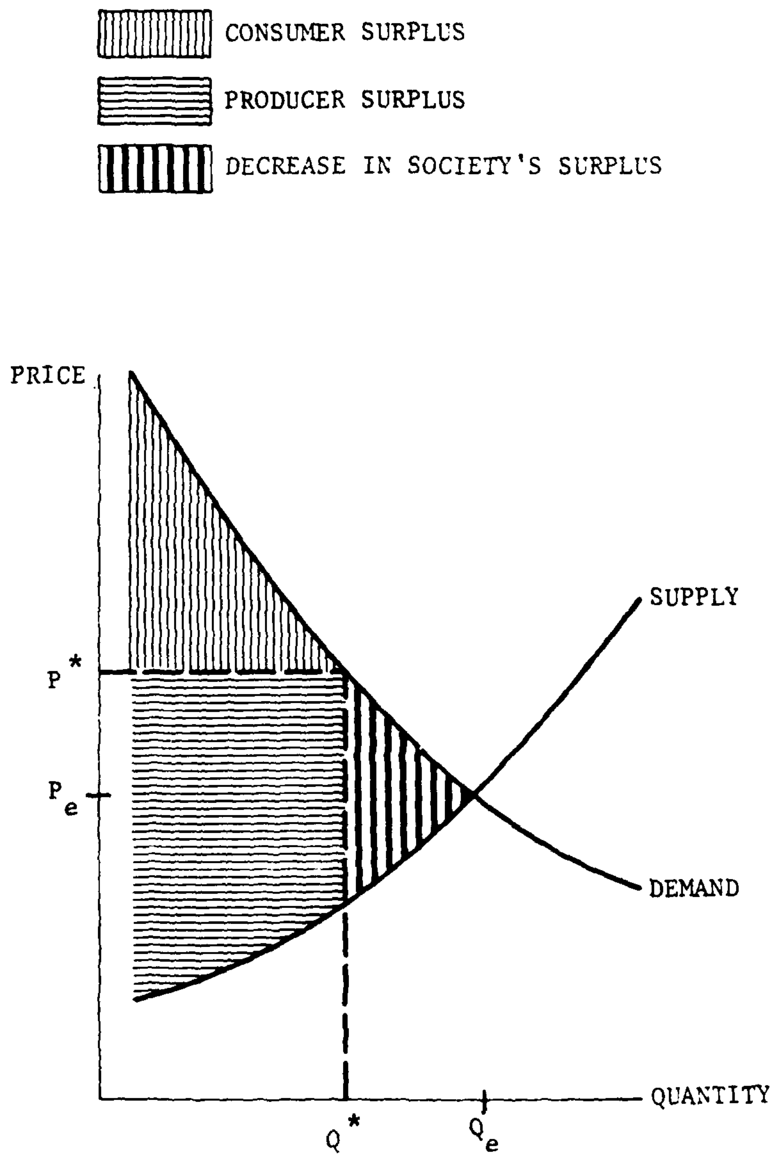

FIGURE A-3
CONSUMER AND PRODUCER SURPLUS AT SUPER-EQUILIBRIUM PRICE

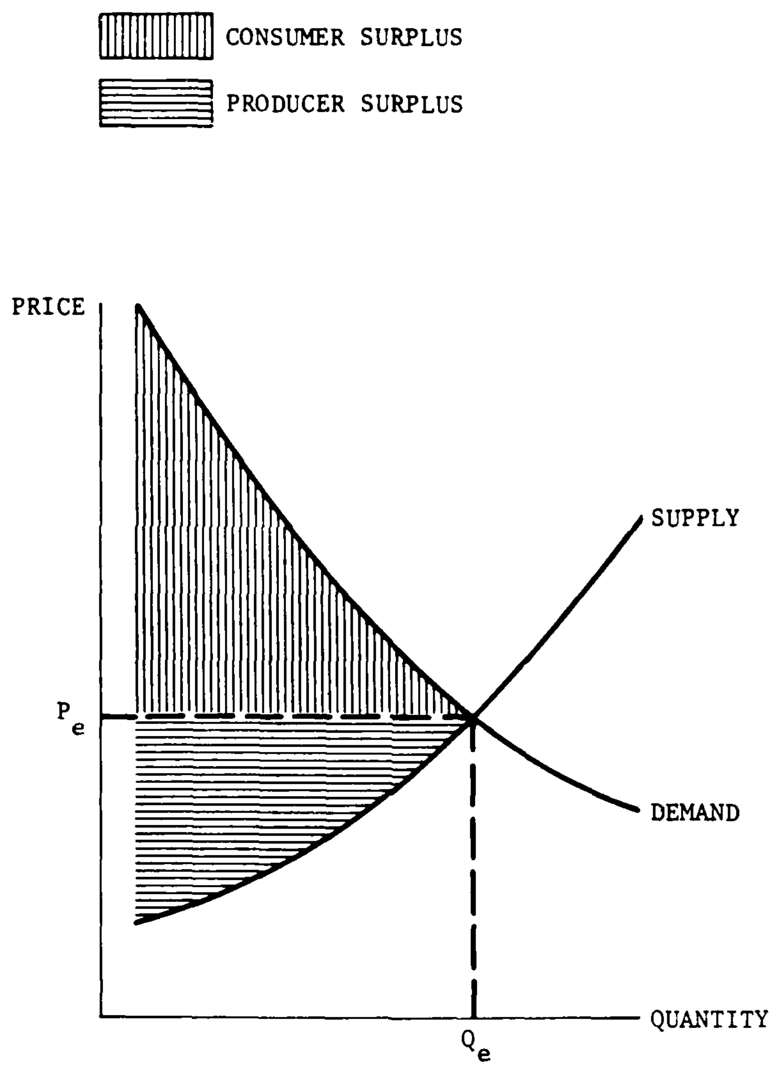

FIGURE A-2
CONSUMER AND PRODUCER SURPLUS AT EQUILIBRIUM PRICE

The attractiveness of marginal cost pricing can also be illustrated with the concepts of consumer and producer surplus. In Figure A-2, an equilibrium price (P_e) and quantity (Q_e) are defined by the intersection of market supply and demand curves. Consumer surplus, which represents the net benefits to consumers from engaging in market transactions, is defined by the area below the demand curve and above the transaction price (which in this example is P_e). Correspondingly, producer surplus, which represents the net benefits to producers from engaging in market transactions, is defined by the area below the transaction price and above the supply curve.

The sum of consumer surplus and producer surplus is termed society's surplus (or transaction surplus). It represents an increase in benefit or utility to society from engaging in market exchange relationships. Following are several figures that demonstrate how society's surplus decreases when prices diverge from marginal costs.

Figure A-3 illustrates the case when an administered price is set above the equilibrium price. In this situation, consumer surplus will decrease. While producer surplus might increase--it might also decrease--the net result will be a decrease in society's surplus.

Figure A-4 illustrates several examples of the impacts on society's surplus when administered prices are set below marginal costs. As shown by these and previous examples, divergent prices never produce results that are superior to marginal cost pricing, and almost always produce inferior results.

In Figure A-4(a), an administered price is set below the equilibrium level. In this example, it is assumed that all demand will be satisfied due to inelastic supply, government mandate, or some other reason. Here, an increase in consumer surplus is more than offset by a decrease in producer surplus.

In Figure A-4(b), an administered price is set below the equilibrium level, and the producer reacts by decreasing output to the profit-maximizing level. The resulting shortage causes a decrease in society's surplus.

In Figure A-4(c), an administered price is set below the equilibrium price, but through some indeterminate means, the equilibrium quantity is produced. In this unusual situation, the increase in consumer surplus exactly offsets the decrease in producer surplus. Similarly, if there were some means of coercing consumers to purchase more than they would normally want to, an administered

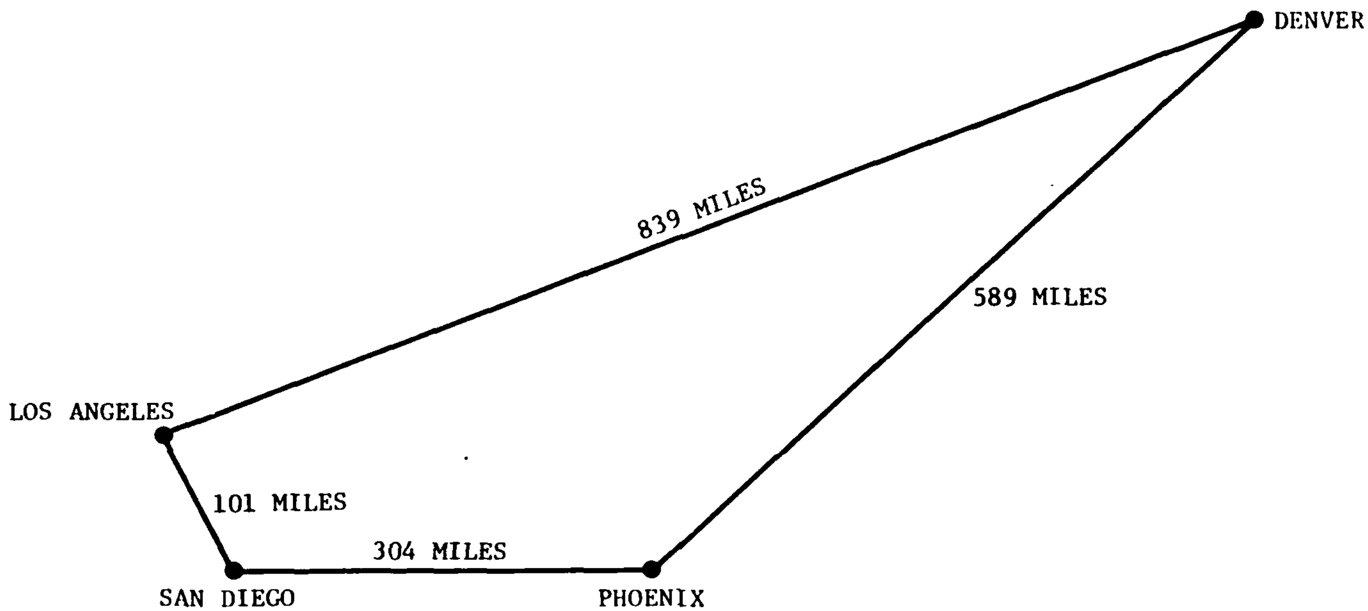

FIGURE A-1
ALTERNATIVE AIR ROUTES WITH
DIFFERENT MARGINAL COSTS BUT IDENTICAL FARES

APPENDIX A

JUSTIFICATION OF MARGINAL COST PRICING

1. INTRODUCTION

Marginal cost pricing consists of charging users the marginal costs associated with their activities. Marginal cost is defined as changes in variable cost. Marginal cost pricing is considered desirable because it maximizes society's net welfare. When divergence from marginal cost pricing takes place, improper economic incentives may result, and the gains of favored parties probably will be more than offset by the losses of disfavored parties. The reasons for this are illustrated in the following section.

2. THE ALLOCATIVE PENALTY ARISING FROM FAILURE TO PRICE AT MARGINAL COSTS

When prices diverge significantly from marginal costs, a misallocation of resources usally occurs. In this situation, society receives a given output at a higher than necessary cost, or alternatively, society receives a diminished output for a given expenditure.

An example of this is illustrated in Figure A-1. A non-stop flight between Los Angeles and Denver commands the same fare as a multi-stop flight via San Diego and Phoenix. The non-stop block distance is 839 miles, and the multi-stop block distance is 994 miles. Ignoring network effects*, the marginal cost of the multi-stop passenger trip is greater than the marginal cost of the shorter non-stop passenger trip.

All else being equal and in the absence of any special motives, society would be better off moving most or all of its Los Angeles-Denver passengers on the non-stop route. Marginal cost pricing would lead to this result. On the other hand, value of service pricing would indicate a lower price for the multi-stop service, and the opposite (and less satisfactory in terms of economic effieiency and allocation of resources) result would occur. Many other classic examples of this phenomenon can be found in transportation and other economic literature.

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* This analysis can be justified if it is assumed that network considerations affect each route equally.

TABLE C-1

DATA BASE FOR EN ROUTE O&M MARGINAL COST REESTIMATION
(COSTS IN THOUSANDS OF FY76 DOLLARS)

EN ROUTE CENTER	OPERATIONS COSTS	MAINTENANCE COSTS - #1	MAINTENANCE COSTS - #2	AC AIRCRAFT HANDLED	GA AIRCRAFT HANDLED	MIL. AIRCRAFT HANDLED	LOW ALT. MILES	HIGH ALT. MILES
Los Angeles	11,587	8,922	4,275	609,233	145,944	266,189	7,330	7,586
Oakland	11,278	7,730	3,496	474,136	134,320	283,803	5,277	5,078
Washington	15,784	6,474	3,756	754,918	337,145	245,865	8,814	5,151
Jacksonville	13,543	8,044	4,754	485,006	266,682	311,683	4,961	5,420
Miami	10,325	6,672	2,168	634,223	273,080	118,866	3,648	4,305
Atlanta	15,990	7,396	3,166	805,484	405,368	198,808	8,478	4,653
Chicago	17,689	9,173	4,493	956,692	636,573	66,364	12,931	7,872
Indianapolis	14,110	7,036	2,356	619,821	525,523	118,458	8,821	4,622
Boston	12,642	7,424	2,819	481,014	272,877	159,959	7,799	5,803
Minneapolis	10,505	7,863	2,395	511,131	293,812	120,827	12,746	9,523
Kansas City	12,333	8,693	2,935	486,130	342,583	171,176	12,158	8,799
Great Falls	1,519	3,917	576	98,445	34,630	58,012	4,159	3,234
Albuquerque	10,299	9,651	3,862	327,003	80,199	455,316	8,356	11,205
New York	18,152	8,188	2,559	1,045,210	385,433	99,125	9,071	5,053
Cleveland	17,843	8,969	3,658	971,401	598,469	75,429	12,498	6,349
Memphis	11,535	7,626	3,184	486,801	329,686	275,695	5,900	5,541
Ft. Worth	12,050	7,797	3,663	568,512	290,089	383,465	9,829	7,620
Houston	12,333	9,273	3,614	426,783	291,147	380,440	6,795	6,255
Seattle	6,591	8,125	2,630	283,857	207,396	140,609	6,747	5,580

*Denver and non-CONUS en route centers are excluded from the data base due to peculiar geographic characteristics or unavailability of data.

measure of maintenance staff requirements; i.e., one that is free of any specified price level).

Maintenance Costs - #2 - The ratio of the operations-to-maintenance costs for each Center, taken from the 1973 Cost Allocation Study data base, and divided into the Operational Costs described above.

AC,GA and MIL Aircraft Handled - Taken from FAA Air Traffic Activity Fiscal Year 1974, September 1974.

Low Altitude and High Altitude Miles - Taken from Table E-10, Airport and Airway Cost Allocation Study, Part I Report Technical Supplement, p. E.26.

Before presenting the reestimation results, a word of explanation is in order concerning the variables and data described above. With the exception of maintenance costs, the measures are relatively straightforward. However, lacking a data source which reports actual maintenance costs by ARTCC, those numbers must be generated through an indirect process. What is described above as "Maintenance Costs - #1" is the approach used in the forecasting model.

This approach has been tested against aggregate actual expenditure and found to be quite satisfactory. However, it has little in the way of an engineering basis. The original Cost Allocation Study determined the standard maintenance man-year requirements for the F&E existing at each location, and then converted those to dollar costs. The measure described as "Maintenance Costs - #2" is an attempt to retain, and at the same time update, that approach. It was considered important to determine whether the reestimation results were sensitive to alternative measures of maintenance costs.

Statistical Results

In the 1973 Study, the preferred En Route O&M cost equation was specified to be a linear function of the three activity variables and a fourth variable defined as the sum of low-altitude and high-altitude air route miles for each Center. That same specification was retained here. Their preferred sample consisted on a specific cross-section of 19 ARTCC's. The same sample composition was likewise used for reestimation. Estimation results employing Maintenance Costs - #1 (the forecasting model approach) were:[6]

[6]In preforming the regressions, the data were converted to the same units used in the original study, i.e., costs and activities in millions, and Mileage in actual units, so that all results would be directly comparable.

$$\hat{C} = 3.684 + \underset{(5.33)}{13.43AC} + \underset{(2.26)}{9.63GA} + \underset{(4.62)}{16.8MIL} + \underset{(1.65)}{.00016\ Mileage}$$

$$R^2 = .913$$

$$\bar{R}^2 = .888$$

$$F = 36.5$$

$$\bar{Y} = 20.3\ (\$mil.)$$

$$S.E.E. = 1.6\ (\$mil.)$$

Results with Maintenance Costs - #2 (updated Cost Allocation Study approach) were:

$$\hat{C} = 0.282 + \underset{(6.00)}{13.83AC} + \underset{(2.56)}{9.96GA} + \underset{(5.27)}{17.60MIL} + \underset{(0.46)}{.0040\ Mileage}$$

$$R^2 = .992$$

$$\bar{R}^2 = .900$$

$$F = 41.4$$

$$\bar{Y} = 15.6\ (\$mil.)$$

$$S.E.E. = 1.5\ (\$mil.)$$

Except for the intercept term and coefficient on the mileage variable[7] --neither of which affects the cost allocation process--the results are remarkable insensitive to the alternative measures of maintenance costs. Note that all of the cost coefficients are statistically significant by any reasonable test. Note also that the GA and AC marginal costs have changed relative to each other and to the MIL coefficient in a manner consistent with the outcome of the Ridge Analysis performed on the original study's data. Both sets of the above results are in FY76 dollars. Since the evaluation statistics are slightly higher for the second equation, and since it represents less of a departure from the Cost Allocation Study's methodology, the marginal costs from that equation were adopted for use in the present study.

[7] There is a school of thought which holds that, in light of the highly insignificant Mileage coefficient, that variable should be dropped from the equation and the other coefficients reestimated. That was in fact done, but the differences between the two sets of marginal costs were negligible and the matter was dismissed.

APPENDIX D

PRICE ELASTICITIES

Price elasticity of demand is defined as the percent change in demand caused by a percent change in price. Numerous studies have attempted to determine price elasticities for air transportation services. However, such studies have encountered major difficulties because of the complexity of air transportation and the wide variety of users. Even though there are minor variations between studies in such things as methodologies, data bases and time periods, there are some common trends.

The Civil Aeronautics Board's Domestic Passenger Fare Investigation (Reference 8) of the early 1970's produced a flurry of activity in the area of price elasticity for commercial air transportation. The CAB's Bureau of Economics, Trans World Airlines and American/United Airlines developed estimates of price elasticities for commercial carriers. At approximately the same time, De Vany (Reference 7) and Brown and Watkins (Reference 5) also conducted similar studies. Overall, the findings indicate that air carriers are relatively inelastic with respect to price and have an elasticity coefficient of approximately -1.0.

General aviation is a composite of numerous types of business and personal flying. Each type of user utilizes a wide variety of aircraft types (with related cost structures) and each has a demand function that reacts differently to price changes. Until recently, very little statistical data has been accumulated with respect to the use of ATC services by general aviation user groups. Even less information has been collected concerning the economic structure of these user groups. Two studies have been performed which give insight to the diversity and magnitude of this problem. The first is a study by Battelle-Columbus for the FAA (Reference 6). This study attempted to derive fixed and variable cost elasticities of demand for a variety of general aviation groups (business/executive, personal, air taxi, instructional, aerial application, industrial/special). The Battelle-Columbus study showed a wide fluctuation in the variable cost elasticities for different user groups ranging from -0.3 to -2.2. A more useful study performed by Ratchford (Reference 17), used an aggregate model for general aviation and estimated that the overall price elasticity of demand is between -1.5 and -2.0.

For cost allocation purposes, the interest is in <u>relative</u> measures of elasticity coefficients. Although one can argue the validity of absolute estimates, the following conclusions based on the above studies represent good estimates of the relative measures of price elasticities of demand for air carrier, general aviation, and government (plus military) users:

1. The elasticity coefficient for air carriers is approximately -1.0.

2. The elasticity coefficient for general aviation is of the order -2.0.

3. Demand by military and government users, while being slightly reduced due to fuel price increases and budget cuts, appear to be essentially cost inelastic (similar to air carriers). Therefore, an elasticity coefficient of -1.0 is used for this group of users.

APPENDIX E

ALLOCATION OF R&D AND F&E PROGRAMS

The general procedures used to develop user allocations for the FAA budget category of R&D and five categories of F&E (en route centers, terminal centers, flight service stations, navigation and landing aids, and other facilities) are described in Section 3.3 of the main report. This appendix shows how the cost responsibility for the individual program elements are initially apportioned between air carriers, general aviation and military users. Assignments are based on engineering estimates of (1) user requirements, (2) user benefits, (3) user elasticities of demand, (4) purpose of FAA programs and services and (5) expected usage of services. The assignments of cost responsibility reflect the existing utilization of air traffic control services by each user group even though the minimum requirements imposed on the system by each user group may be different. The impact of minimum requirements on general aviation cost responsibilities is discussed in Reference 18.

The allocation is done in two steps. Cost responsibility of each program element is first split between general aviation and a combined group including both air carrier and military. The assignments of cost responsibilities for most program elements are approximate, being limited generally to one of five points on a continuous scale: (1) all general aviation, (2) predominantly general aviation, (3) equally split between air carrier plus military and general aviation, (4) predominantly air carrier plus military and (5) all air carrier plus military. The cost responsibility for the eighteen program elements comprising the R&D budget are shown in Figure E-1. Figure E-2 presents the split for the major F&E budget categories followed by the program element allocations for terminal F&E in Figures E-3 through E-5, and for navigation and landing aids F&E in Figure E-6. The program elements composing en route, FSS and other F&E categories are listed in Table E-1. However, distinctions between the program elements are insufficient to warrant making different individual allocations. For these F&E categories, the overall allocation shown in Figure E-2 applies to all elements.

The second step of the allocation process is to split the air carrier and military share between the two user groups. Allocations are made for aggregate programs because of the difficulties in assessing cost responsibilities at the program element level. Since requirements imposed on FAA en route, terminal and navigation facilities by air carrier and military users are somewhat homogeneous, objective measures are used to guide the apportionment of these F&E categories:

F&E Budget Category	Allocation Measure Used
En Route	No. of IFR aircraft handled
Terminal	
Radar	Total instrument operations
Automation	ARTS III instrument operations
Other	Non-ARTS III instrument operations
Navaids	
En Route	Total en route operations
Landing Aids	Total instrument operations

The allocation of cost responsibility for the combined air carrier plus military portion is graphically presented in Figure E-7.

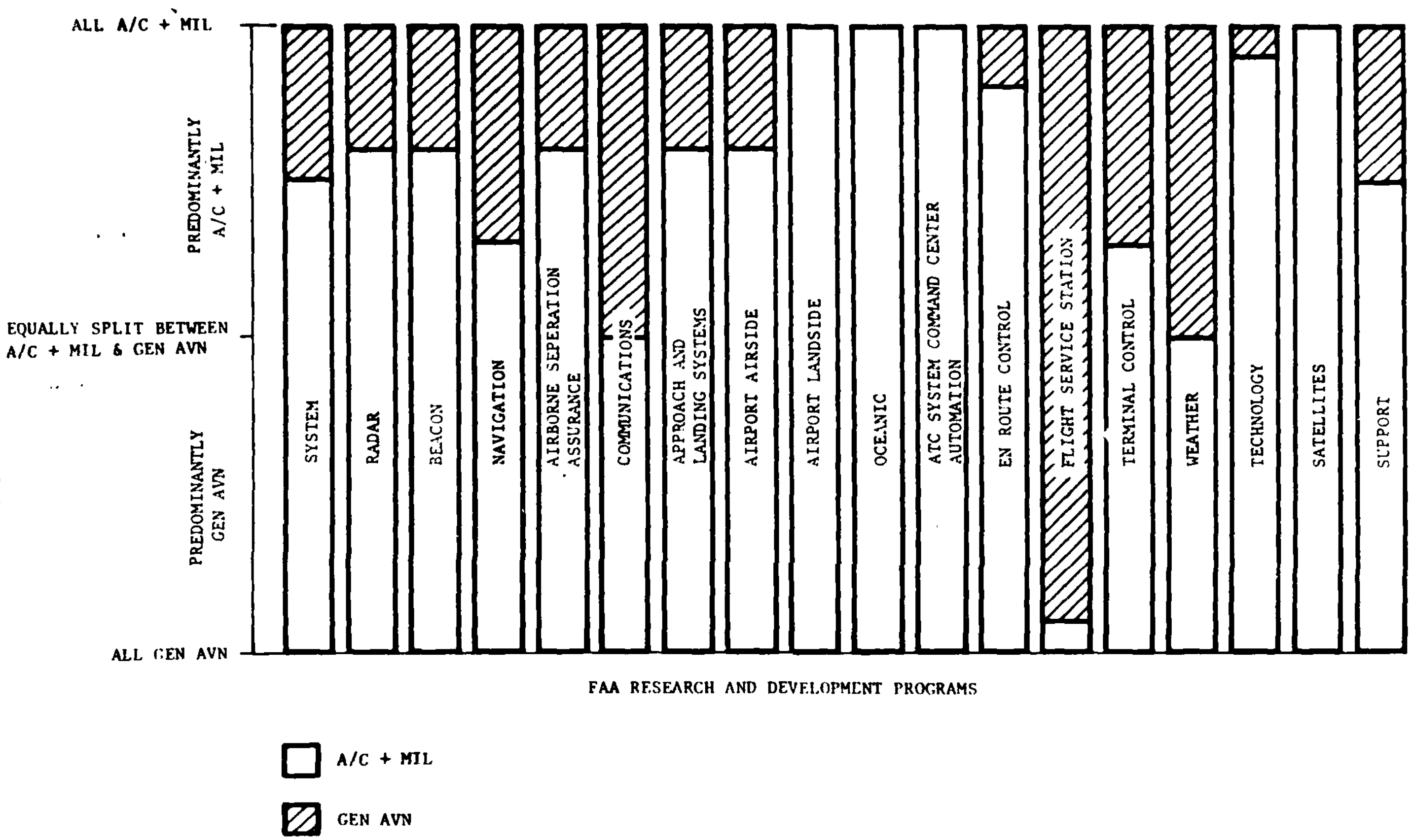

FIGURE E-1
ALLOCATION OF R&D TRUST FUND RESPONSIBILITY
(LESS PUBLIC INTEREST PROGRAMS)

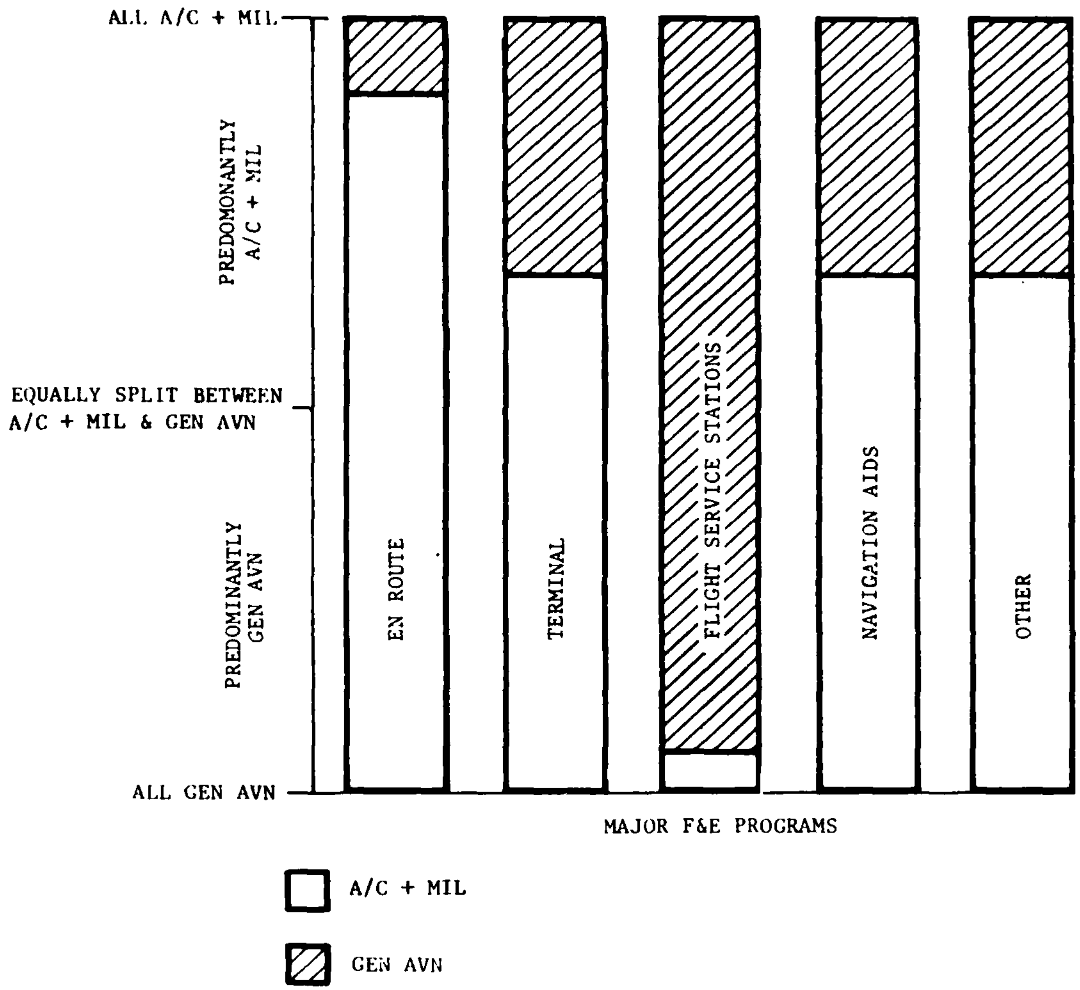

FIGURE E-2
ALLOCATION OF TOTAL F&E COST RESPONSIBILITY

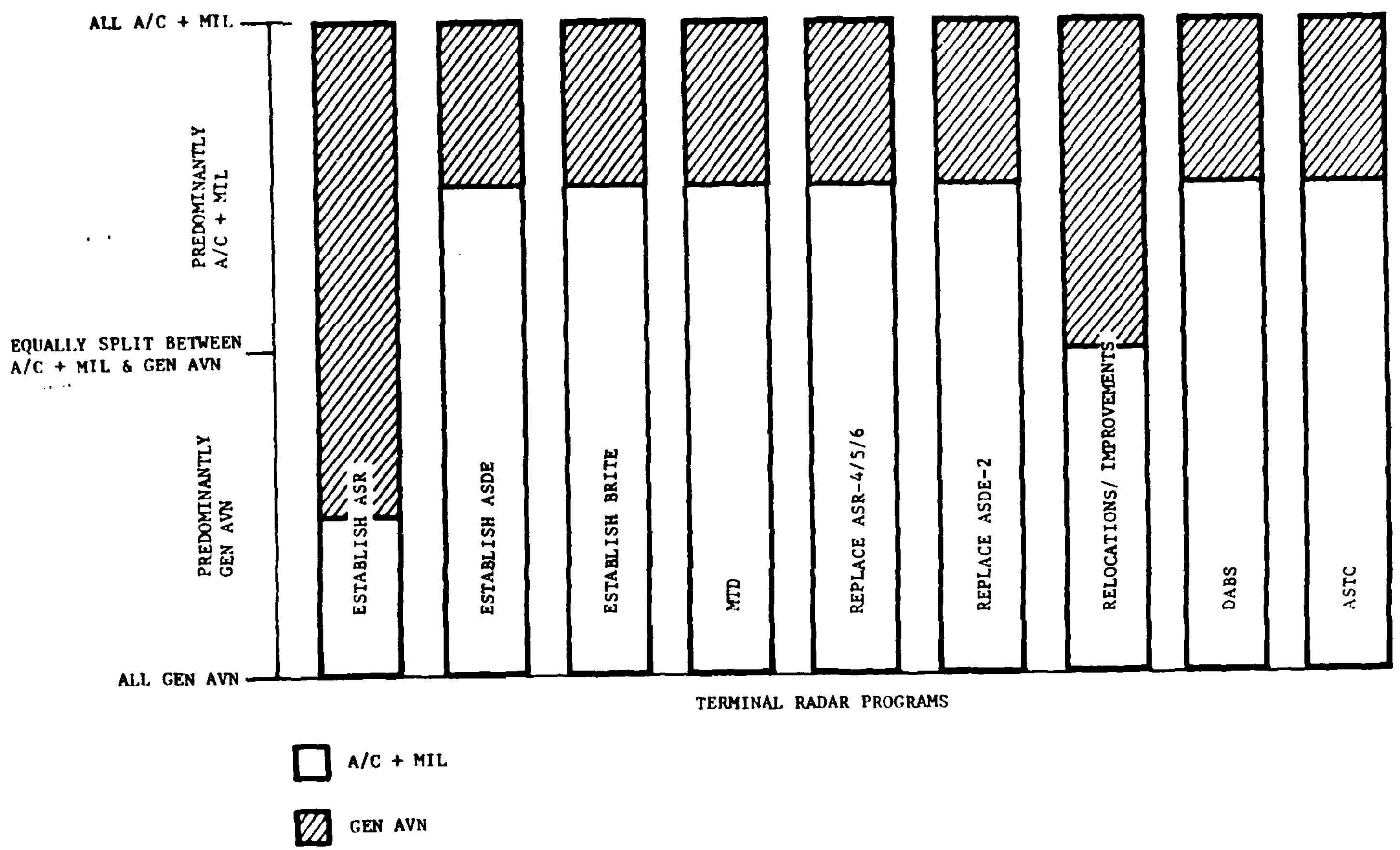

FIGURE E-3
ALLOCATION OF TERMINAL RADAR F&E COST RESPONSIBILITY

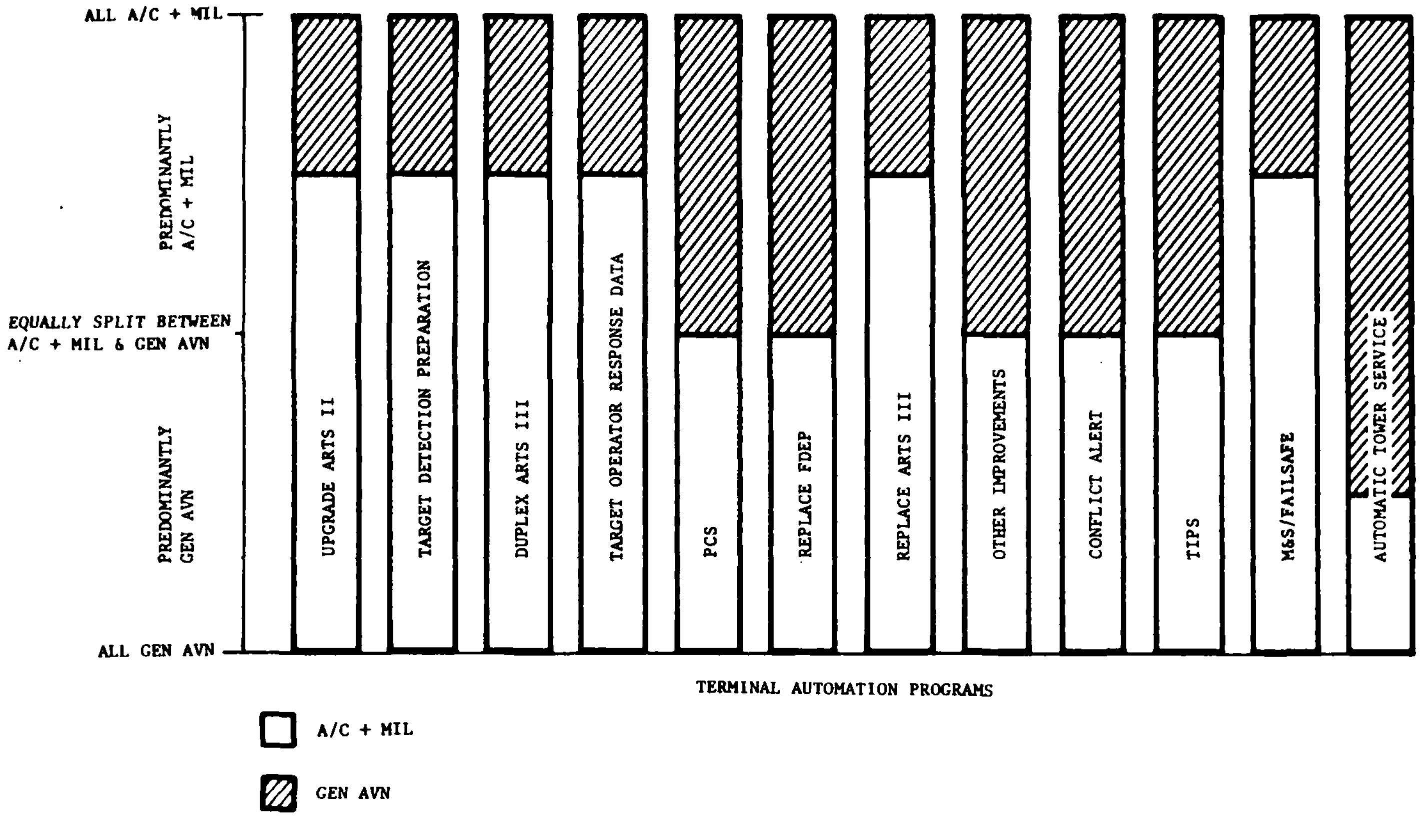

FIGURE E-4
ALLOCATION OF TERMINAL AUTOMATION F&E COST RESPONSIBILITY

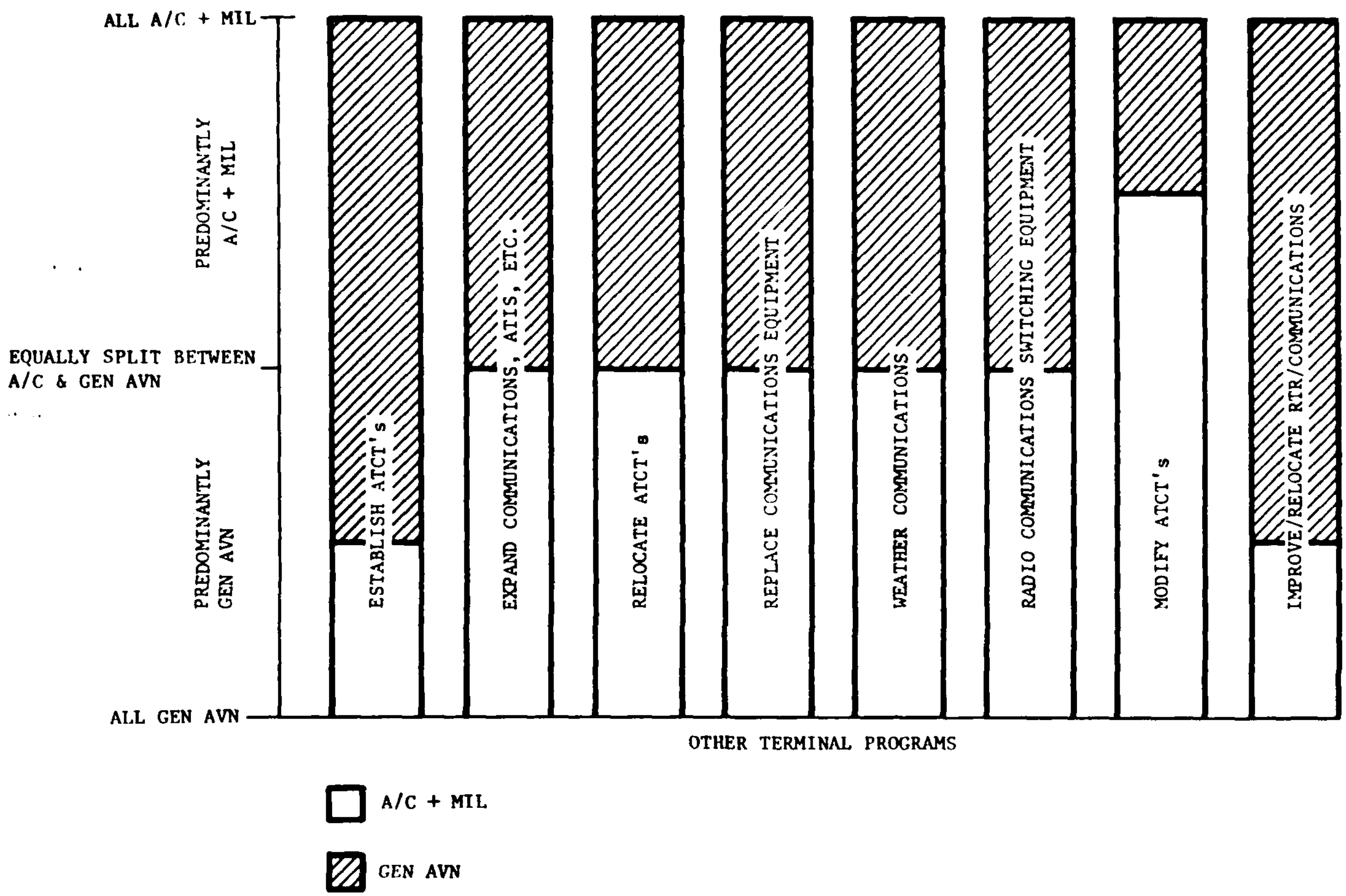

FIGURE E-5
ALLOCATION OF OTHER TERMINAL F&E COST RESPONSIBILITY

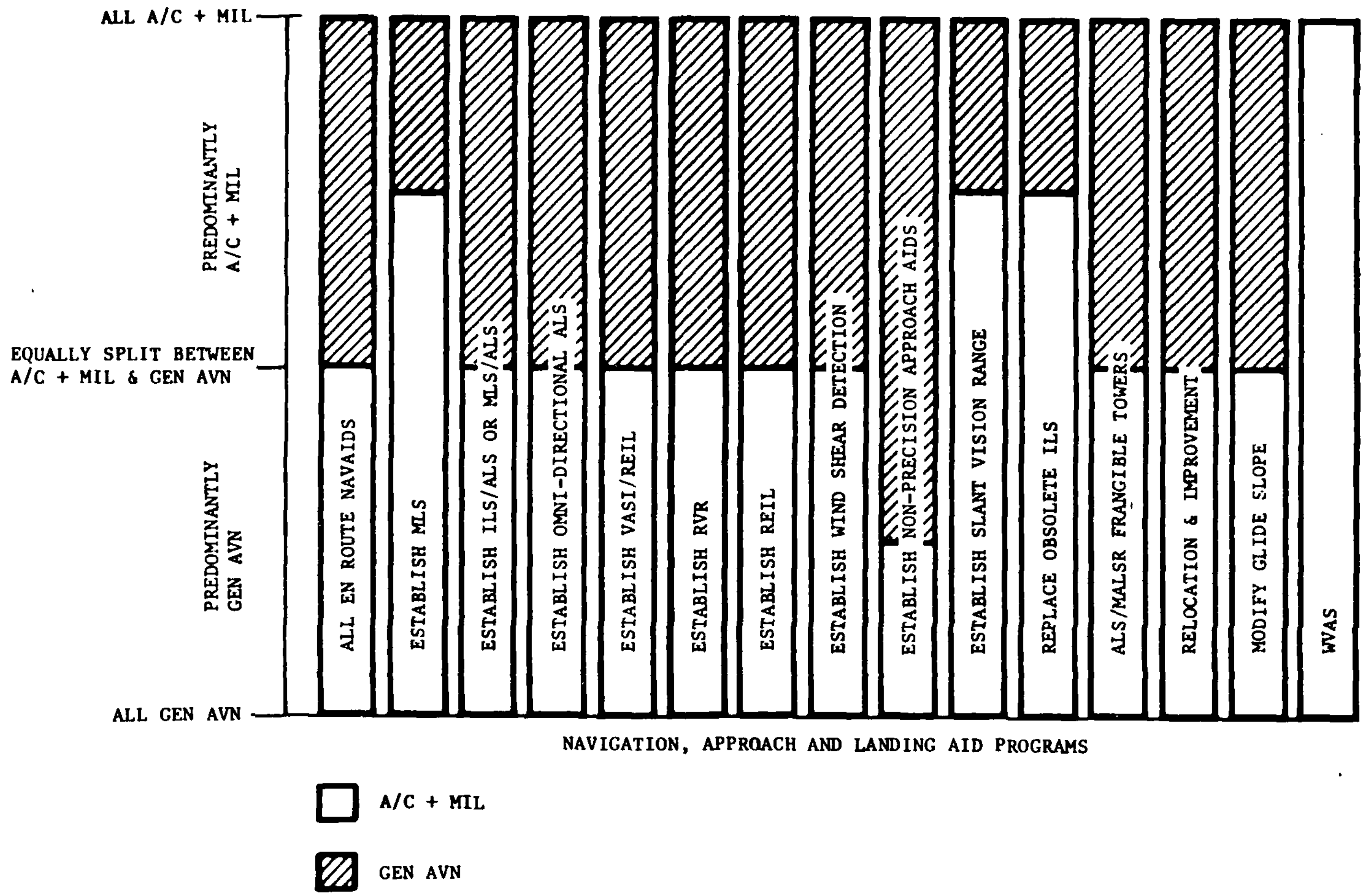

FIGURE E-6
ALLOCATION OF NAVAID AND LANDING AID COST RESPONSIBILITY

TABLE E-1

ELEMENTS OF F&E PROGRAMS

1. En Route F&E

   a. Long Range Radar

      Establish and Expand ARSR and ATCRBS
      Moving Target Detection
      Hazardous Weather
      DABS

   b. Automation

      24-hour Stage A
      NADIN 2
      Improvements
      Relocation
      E-MSAW
      ATCSCC
      Conflict Resolution
      Flight Plan Probe
      E-TABS
      En Route Metering
      Oceanic Automation

   c. Other En Route

      Establish RCAG
      Sector Addition
      Replacement and Modification Components
      Modification and Improvement of Facilities
      Radio Communications Switching

2. Terminal F&E

   (See Figures E-3 through E-5)

3. Flight Service Station F&E

      Establish Direction Finders
      Expand Communications
      Part-Time and Decommissioning
      Random A Access Voice System
      Communications Switching System
      Replacement of Communications Equipment
      Improvements, Relocation and Modification

TABLE F-2

ALLOCATION OF FY77 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		75.0	1.6	47.0	18.4	8.0
F&E	CENTERS	46.5	0.0	33.5	4.6	8.4
	TOWERS	83.3	1.6	44.4	26.9	10.6
	FSS	16.4	0.0	0.8	15.6	0.0
	NAVAIDS	35.9	0.0	19.4	11.9	4.7
	OTHER	18.0	0.0	12.0	5.9	0.0
	TOTAL F&E	200.0	1.6	109.8	64.9	23.7
O&M	CENTERS	511.9	55.7	252.3	105.8	98.0
	TOWERS	477.5	40.9	233.4	169.3	34.0
	FSS	145.5	3.9	5.8	94.5	41.4
	OTHER	67.4	6.7	29.7	22.3	8.7
	TOTAL O&M	1172.4	107.2	521.2	392.0	152.0
SUPPORT	I&M	146.7	38.9	52.7	39.7	15.4
	ADM F ST	153.4	153.4	0.0	0.0	0.0
	ADM RED	9.2	9.2	0.0	0.0	0.0
	DEV DIR	7.2	0.0	4.6	1.8	0.8
	A-P ADM	20.4	2.2	15.7	2.5	0.0
	CENT TRN	77.2	27.1	25.0	18.2	7.0
	DIR, S&S	151.7	32.6	64.1	39.9	15.2
	TOTAL SUP	565.8	263.3	162.2	102.0	38.3
FE&D		21.9	21.9	0.0	0.0	0.0
NTL CAP AP		30.6	30.6	0.0	0.0	0.0
GRANTS		521.3	0.0	449.8	71.5	0.0
TOTAL		2587.1	426.2	1289.9	648.9	222.1
ADJUSTMENTS		0.0	0.0	12.9	-38.9	26.0
TOTAL		2587.1	426.2	1302.8	610.0	248.0

TABLE F-4
(CONCLUDED)

ALLOCATION OF FY86 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	75.7	0.0	54.5	7.6	13.6
	TOWERS	75.4	1.5	39.9	24.4	9.6
	FSS	19.4	0.0	1.0	18.4	0.0
	NAVAIDS	40.9	0.0	22.1	13.5	5.3
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	238.8	1.5	135.8	72.9	28.5
O&M	CENTERS	635.5	57.5	304.9	182.5	90.6
	TOWERS	579.2	40.8	265.7	242.8	29.8
	FSS	92.2	3.6	4.4	75.3	8.8
	OTHER	72.5	6.2	31.6	27.5	7.1
	TOTAL O&M	1379.4	108.1	606.6	528.3	136.4
SUPPORT	I&R	185.8	47.9	65.8	57.3	14.8
	AER & ST	186.6	186.6	0.0	0.0	0.0
	AER MED	41.9	41.9	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	27.6	2.0	21.9	3.7	0.0
	CENT TRN	101.4	25.4	36.8	31.4	8.1
	LIB, S&S	175.3	30.2	74.9	55.5	14.7
	TOTAL SUP	696.2	303.7	204.3	149.8	38.3
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AF		28.4	28.4	0.0	0.0	0.0
GRANTS		455.1	0.0	388.8	66.2	0.0
TOTAL		2892.4	463.6	1382.1	835.4	211.3
ADJUSTMENTS		0.0	0.0	13.8	-47.2	33.4
TOTAL		2892.4	463.6	1396.0	788.2	244.7

TABLE F-1
(CONTINUED)

ALLOCATION OF FY85 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	70.3	0.0	50.6	7.0	12.7
	TOWERS	73.9	1.5	39.4	23.9	9.4
	FSS	33.9	0.0	1.7	32.2	0.0
	NAVAIDS	42.3	0.0	22.8	14.0	5.5
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	247.8	1.5	132.6	86.1	27.6
O&M	CENTERS	613.3	56.4	292.6	174.0	90.2
	TOWERS	565.0	40.7	258.6	235.8	30.0
	FSS	94.3	3.6	4.5	77.1	9.1
	OTHER	71.4	6.2	30.9	27.1	7.2
	TOTAL O&M	1344.1	106.9	586.6	514.0	136.5
SUPPORT	I&M	180.3	46.4	63.5	55.6	14.8
	ADM F ST	181.7	181.7	0.0	0.0	0.0
	AVM MED	11.5	11.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-F ADM	27.2	2.0	21.5	3.6	0.0
	CENT TRN	98.8	25.1	35.4	30.3	8.0
	LIB, S&S	171.5	30.2	72.8	53.9	14.6
	TOTAL SUP	678.6	296.9	198.0	145.5	38.2
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AF		28.4	28.4	0.0	0.0	0.0
GRANTS		459.7	0.0	393.2	66.5	0.0
TOTAL		2853.2	455.5	1357.1	830.3	210.3
ADJUSTMENTS		0.0	0.0	13.6	-46.8	33.2
TOTAL		2853.2	455.5	1370.6	783.6	243.5

TABLE F-1
(CONTINUED)

ALLOCATION OF FY84 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	59.5	0.0	42.9	6.0	10.7
	TOWERS	76.2	1.5	40.4	24.7	9.7
	FSS	41.1	0.0	2.1	39.0	0.0
	NAVAIDS	43.9	0.0	23.7	14.5	5.7
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	248.2	1.5	127.4	93.2	26.1
O&M	CENTERS	594.4	55.2	282.6	166.8	89.9
	TOWERS	549.8	40.4	251.4	227.8	30.2
	FSS	96.5	3.6	4.6	79.0	9.3
	OTHER	70.4	6.2	30.3	26.6	7.3
	TOTAL O&M	1311.1	105.4	568.9	500.2	136.6
SUPPORT	I&M	175.2	44.8	61.5	54.1	14.8
	ADM F ST	176.8	176.8	0.0	0.0	0.0
	ADM MEC	11.2	11.2	0.0	0.0	0.0
	DEV DIS	7.6	0.0	4.9	1.9	0.8
	A-P ADM	26.6	2.0	21.0	3.6	0.0
	CENT TRN	96.5	25.1	34.1	29.3	8.0
	DIR, S&S	168.1	30.2	70.9	52.4	14.6
	TOTAL SUP	661.9	290.0	492.4	141.3	38.2
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		463.7	0.0	396.5	67.1	0.0
TOTAL		2807.9	447.2	1331.8	820.0	208.9
ADJUSTMENTS		0.0	0.0	13.3	-46.1	32.8
TOTAL		2807.9	447.2	1345.1	773.9	241.7

TABLE F-4
(CONTINUED)

ALLOCATION OF FY83 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	54.2	0.0	39.0	5.4	9.8
	TOWERS	75.3	1.5	39.9	24.4	9.6
	FSS	36.6	0.0	1.8	34.8	0.0
	NAVAIDS	45.5	0.0	24.6	15.0	5.9
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	239.4	1.5	123.7	88.6	25.3
O&M	CENTERS	577.3	55.3	274.8	158.0	89.2
	TOWERS	534.6	39.9	245.5	218.9	30.3
	FSS	98.6	3.6	4.7	80.8	9.5
	OTHER	69.5	6.2	29.9	26.1	7.3
	TOTAL O&M	1280.0	105.0	555.0	483.8	136.2
SUPPORT	I&M	170.3	43.2	60.0	52.3	14.7
	ADM F ST	173.1	173.1	0.0	0.0	0.0
	ADM MED	10.9	10.9	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	26.0	2.0	20.5	3.5	0.0
	CENT TRN	94.1	25.1	33.0	28.1	7.9
	DIR, S&S	164.8	30.2	69.4	50.7	14.5
	TOTAL SUP	646.8	284.5	187.8	136.6	37.9
F&ED		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		461.4	0.0	394.5	66.8	0.0
TOTAL		2750.3	441.2	1307.6	794.0	207.4
ADJUSTMENTS		0.0	0.0	13.1	-44.8	31.8
TOTAL		2750.3	441.2	1320.6	749.2	239.2

TABLE F-1
(CONTINUED)

ALLOCATION OF FY82 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	43.4	0.0	34.2	4.3	7.8
	TOWERS	79.5	1.5	42.1	25.7	10.1
	FSS	44.0	0.0	2.2	41.8	0.0
	NAVAIDS	47.2	0.0	25.5	15.6	6.1
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	241.5	1.5	119.4	96.5	24.1
O&M	CENTERS	563.6	54.0	268.7	152.0	88.9
	TOWERS	517.6	39.7	239.1	208.5	30.3
	FSS	100.7	3.6	4.8	82.7	9.6
	OTHER	68.6	6.2	29.5	25.5	7.4
	TOTAL O&M	1250.6	103.5	542.1	468.8	136.2
SUPPORT	I&R	165.7	41.6	58.6	50.7	14.7
	ADM F ST	168.5	168.5	0.0	0.0	0.0
	AIR MED	10.5	10.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-F ADM	25.5	2.0	20.1	3.4	0.0
	CENT TRN	92.0	25.4	32.0	27.0	7.8
	CIR, S&S	161.6	30.2	67.9	49.1	14.4
	TOTAL SUP	631.4	277.9	183.6	132.1	37.8
FR&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		463.0	0.0	396.3	66.6	0.0
TOTAL		2709.5	433.4	1288.0	782.2	206.1
ADJUSTMENTS		0.0	0.0	12.9	-44.2	31.3
TOTAL		2709.5	433.1	1300.9	738.0	237.4

TABLE F-4
(CONTINUED)

ALLOCATION OF FY81 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	75.9	0.0	54.7	7.6	13.7
	TOWERS	94.2	1.5	50.1	30.6	12.1
	FSS	42.6	0.0	2.1	40.5	0.0
	NAVAIDS	52.3	0.0	28.2	17.3	6.8
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	292.5	1.5	153.5	105.0	32.5
O&M	CENTERS	539.6	51.9	258.4	141.2	88.3
	TOWERS	495.3	39.6	232.9	192.8	30.1
	FSS	102.9	3.6	4.9	84.5	9.8
	OTHER	67.3	6.2	29.1	24.5	7.5
	TOTAL O&M	1205.1	101.3	525.0	443.1	135.7
SUPPORT	I&M	158.7	40.1	56.4	47.6	14.6
	ADM P ST	163.4	163.4	0.0	0.0	0.0
	ACM MED	9.8	9.8	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	25.0	2.0	19.7	3.3	0.0
	CENT TRN	88.7	25.4	30.7	25.3	7.7
	DIR, S&S	157.0	30.2	66.0	46.4	14.3
	TOTAL SUP	610.2	270.6	177.7	124.5	37.4
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		465.7	0.0	399.2	66.5	0.0
TOTAL		2696.5	423.7	1302.0	757.2	213.7
ADJUSTMENTS		0.0	0.0	13.0	-43.3	30.3
TOTAL		2696.5	423.7	1315.0	713.9	244.0

TABLE F-1
(CONTINUED)

ALLOCATION OF FY80 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	97.7	0.0	70.4	9.8	17.6
	TOWERS	90.0	1.5	47.8	29.2	11.5
	FSS	40.4	0.0	2.0	38.4	0.0
	NAVAIDS	51.5	0.0	27.8	17.0	6.7
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	307.1	1.5	166.4	103.4	35.8
O&M	CENTERS	508.7	51.2	245.2	125.3	86.9
	TOWERS	474.0	39.6	224.1	180.2	30.1
	FSS	105.0	3.6	5.1	86.3	10.0
	OTHER	65.8	6.2	28.4	23.5	7.6
	TOTAL O&M	1153.5	100.6	502.9	415.3	134.7
SUPPORT	I&M	150.9	39.3	53.3	44.0	14.3
	ADM F ST	158.6	158.6	0.0	0.0	0.0
	ADM REC	9.5	9.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	24.7	2.0	19.5	3.2	0.0
	CENT TRN	85.0	25.1	29.1	23.4	7.5
	DIR, S&S	151.6	30.2	63.7	43.6	14.2
	TOTAL SUP	588.0	264.8	170.4	116.1	36.8
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AF		28.4	28.4	0.0	0.0	0.0
GRANTS		479.7	0.0	412.9	66.8	0.0
TOTAL		2651.3	417.1	1299.2	719.8	215.2
ADJUSTMENTS		0.0	0.0	13.0	-41.8	28.8
TOTAL		2651.3	417.1	1312.2	678.0	244.0

TABLE F-1
(CONTINUED)

ALLOCATION OF FY79 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	65.2	0.0	47.0	6.5	11.7
	TOWERS	80.6	1.5	42.7	26.1	10.3
	FSS	37.9	0.0	1.9	36.0	0.0
	NAVAIDS	63.8	0.0	34.5	21.1	8.3
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	275.0	1.5	144.4	98.7	30.3
O&M	CENTERS	496.8	51.2	242.2	115.7	87.7
	TOWERS	455.5	39.2	217.2	169.0	30.0
	FSS	107.2	3.6	5.2	88.1	10.2
	OTHER	64.6	6.2	28.1	22.6	7.7
	TOTAL O&M	1124.1	100.2	492.7	395.4	135.7
SUPPORT	I&M	147.0	38.3	52.3	42.0	14.4
	ADM F ST	154.7	154.7	0.0	0.0	0.0
	AER MED	9.3	9.3	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	24.1	2.0	19.1	3.1	0.0
	CERT TRN	82.9	25.1	28.2	22.0	7.5
	DIR, S&S	148.6	30.2	62.6	41.6	14.2
	TOTAL SUP	574.3	259.7	167.0	110.6	37.0
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		484.8	0.0	417.4	67.4	0.0
TOTAL		2581.2	411.6	1268.2	690.4	211.0
ADJUSTMENTS		0.0	0.0	12.7	-40.3	27.6
TOTAL		2581.2	411.6	1280.8	650.1	238.6

TABLE F-1
(CONTINUED)

ALLOCATION OF FY78 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	54.4	0.0	39.2	5.4	9.8
	TOWERS	67.7	1.5	35.7	21.8	8.6
	FSS	9.0	0.0	0.4	8.5	0.0
	NAVAIDS	44.3	0.0	23.9	14.6	5.8
	OTHER	27.4	0.0	18.4	9.1	0.0
	TOTAL F&E	202.8	1.5	117.7	59.5	24.2
O&M	CENTERS	488.0	52.3	238.9	108.3	88.5
	TOWERS	440.9	38.1	211.4	161.3	30.1
	FSS	107.2	3.6	5.3	87.9	10.4
	OTHER	63.7	6.2	27.8	21.8	7.9
	TOTAL O&M	1099.8	100.2	483.4	379.3	136.9
SUPPORT	I&M	144.3	37.1	51.8	40.7	14.7
	ADM F ST	150.7	150.7	0.0	0.0	0.0
	AEM MED	9.1	9.1	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	23.6	2.0	18.6	3.0	0.0
	CENT TEM	81.3	25.1	27.6	21.1	7.5
	DIR, S&S	146.3	30.2	61.7	40.1	14.3
	TOTAL SUP	562.8	254.1	164.5	106.7	37.4
F&ED		20.3	20.3	0.0	0.0	0.0
MTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		488.6	0.0	420.7	67.8	0.0
TOTAL		2477.0	406.1	1232.9	631.6	206.4
ADJUSTMENTS		0.0	0.0	12.3	-37.6	25.3
TOTAL		2477.0	406.1	1245.3	594.0	231.7

TABLE F-1

ALLOCATION OF FY77 BASELINE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		69.6	1.5	43.6	17.0	7.5
F&E	CENTERS	43.8	0.0	31.5	4.4	7.9
	TOWERS	78.4	1.5	41.5	25.4	10.0
	FSS	15.4	0.0	0.8	14.7	0.0
	NAVAIDS	33.9	0.0	18.3	11.2	4.4
	OTHER	16.9	0.0	11.4	5.6	0.0
	TOTAL F&E	188.4	1.5	103.5	61.2	22.3
O&M	CENTERS	474.9	51.7	234.1	98.2	91.0
	TOWERS	443.0	37.9	216.5	157.1	31.5
	FSS	107.2	3.6	5.4	87.7	10.5
	OTHER	62.5	6.2	27.6	20.7	8.0
	TOTAL O&M	1087.6	99.4	483.5	363.6	141.0
SUPPORT	I&M	136.1	36.1	48.9	36.8	14.3
	ADM F ST	142.3	142.3	0.0	0.0	0.0
	ADM MED	8.5	8.5	0.0	0.0	0.0
	DEV DIR	6.7	0.0	4.3	1.7	0.7
	A-P ADM	18.9	2.0	14.6	2.3	0.0
	CENT TRN	71.6	25.4	23.2	16.9	6.5
	DIR, S&S	140.8	30.2	59.5	37.0	14.1
	TOTAL SUP	524.9	244.3	150.4	94.7	35.5
FR&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		490.9	0.0	423.5	67.4	0.0
TOTAL		2410.1	395.4	1204.5	603.9	206.3
ADJUSTMENTS		0.0	0.0	12.0	-36.2	24.2
TOTAL		2410.1	395.4	1216.5	567.7	230.5

APPENDIX F

DETAILED ALLOCATIONS OF FAA PROGRAM COSTS

Detailed allocations of baseline FAA Airport and Airway System Cost categories from FY77 through FY86 are presented in FY76 constant dollars in Table F-1 and in current dollars in Table F-2. Corresponding allocations of cost categories under the alternative cost projections are found in Tables F-3 and F-4.

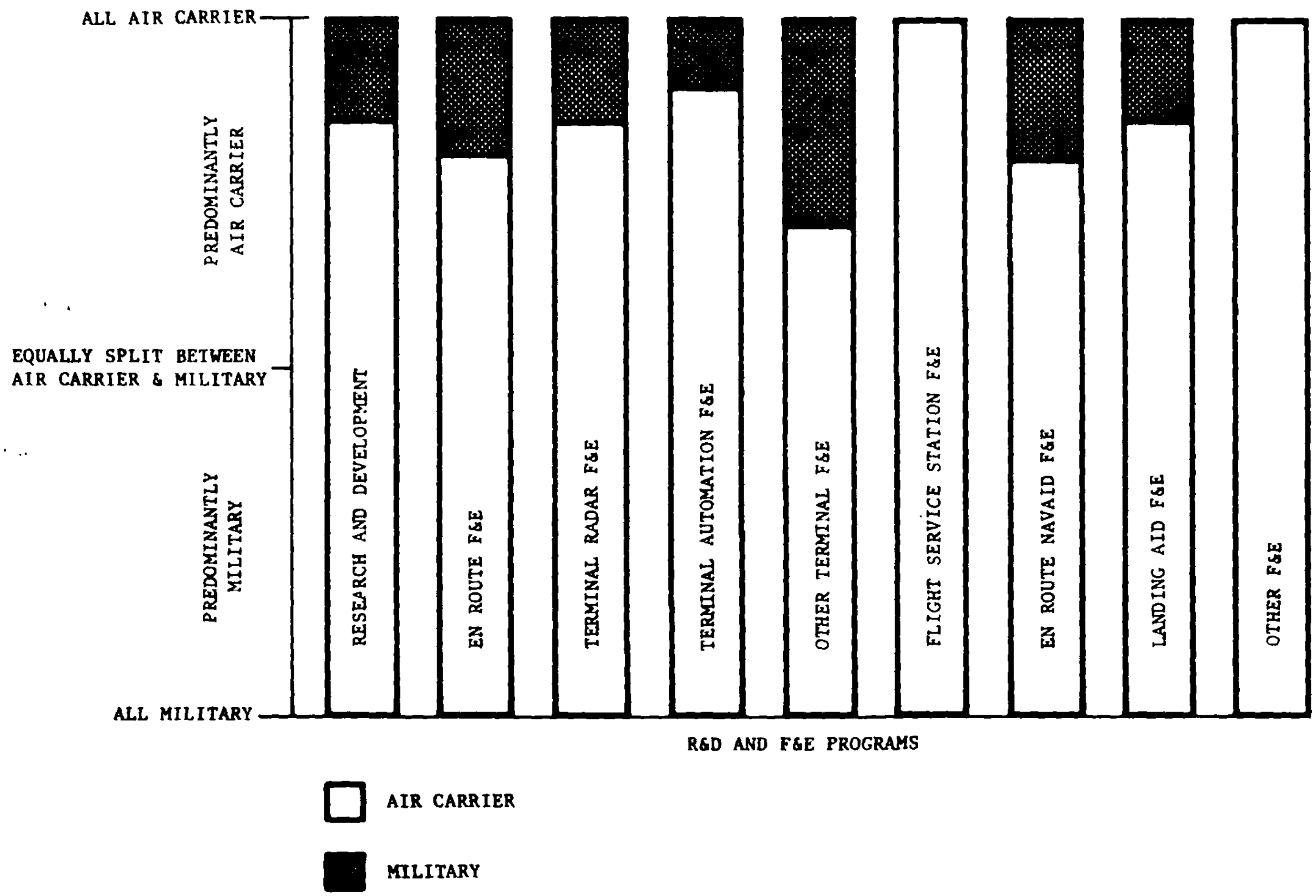

FIGURE E-7
ALLOCATION OF COST RESPONSIBILITIES BETWEEN AIR CARRIER AND MILITARY

TABLE E-1
(Concluded)

Automation
Automated Weather System (AV-AWOS)

4. Navaids and Landing Systems F&E

(See Figure E-6)

5. Other F&E

a. Housing and Utilities

Housing
DSHA and EPA Ramps
Maintenance of Working Equipment
Replacement, Modification and Improvement
Solar Power

b. Aircraft Replacement and Modernization

c. Miscellaneous

TABLE F-2
(CONTINUED)

ALLOCATION OF FY78 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		85.0	1.7	53.3	20.8	9.2
F&E	CENTERS	61.5	0.0	44.3	6.1	11.1
	TOWERS	75.5	1.7	39.8	24.4	9.6
	FSS	9.9	0.0	0.5	9.4	0.0
	NAVAIDS	48.6	0.0	26.2	16.0	6.3
	OTHER	30.1	0.0	20.2	9.9	0.0
	TOTAL F&E	225.4	1.7	131.0	65.8	27.0
O&M	CENTERS	558.3	59.8	273.3	123.9	101.2
	TOWERS	504.4	43.6	241.8	184.5	34.5
	FSS	122.6	4.1	6.0	100.5	11.9
	OTHER	72.9	7.1	31.8	25.0	9.0
	TOTAL O&M	1258.2	114.6	553.0	433.9	156.6
SUPPORT	I&M	165.1	42.4	59.3	46.5	16.8
	ADM F ST	172.4	172.4	0.0	0.0	0.0
	ADM MED	10.4	10.4	0.0	0.0	0.0
	DEV DIR	8.7	0.0	5.6	2.2	1.0
	A-P ADM	27.0	2.3	21.2	3.4	0.0
	CENT TRN	93.0	28.7	31.6	24.1	8.6
	DIR, S&S	167.4	34.5	70.6	45.9	16.4
	TOTAL SUP	643.8	290.7	188.2	122.1	42.7
PE&D		23.3	23.3	0.0	0.0	0.0
NTL CAP AP		32.5	32.5	0.0	0.0	0.0
GRANTS		555.0	0.0	478.0	77.0	0.0
TOTAL		2823.2	464.5	1403.5	719.7	235.5
ADJUSTMENTS		0.0	0.0	14.0	-42.8	28.8
TOTAL		2823.2	464.5	1417.5	676.9	264.3

TABLE F-2
(CONTINUED)

ALLOCATION OF FY79 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		89.8	1.8	56.3	22.0	9.7
F&E	CENTERS	78.8	0.0	56.8	7.9	14.2
	TOWERS	95.9	1.8	50.8	31.0	12.2
	FSS	44.0	0.0	2.2	41.8	0.0
	NAVAIDS	74.1	0.0	40.0	24.5	9.6
	OTHER	31.9	0.0	21.4	10.5	0.0
	TOTAL F&E	324.7	1.8	171.2	115.7	36.1
O&M	CENTERS	600.6	61.9	292.8	139.9	106.1
	TOWERS	550.7	47.4	262.7	204.3	36.3
	FSS	129.6	4.4	6.3	106.6	12.4
	OTHER	78.2	7.5	34.0	27.3	9.4
	TOTAL O&M	1359.0	121.1	595.7	478.1	164.1
SUPPORT	I&M	177.8	46.3	63.3	50.8	17.4
	ADM P ST	187.1	187.1	0.0	0.0	0.0
	ACB MED	11.3	11.3	0.0	0.0	0.0
	DEV DIR	9.2	0.0	5.9	2.3	1.0
	A-P ADM	29.2	2.4	23.0	3.7	0.0
	CENT TRN	100.2	30.3	34.1	26.7	9.1
	DIR, S&S	179.6	36.5	75.6	50.3	17.2
	TOTAL SUP	694.3	313.9	201.9	133.8	44.7
FE&D		24.6	24.6	0.0	0.0	0.0
MTL CAP AP		34.3	34.3	0.0	0.0	0.0
GRANTS		590.0	0.0	508.0	82.0	0.0
TOTAL		3116.8	497.6	1533.1	831.6	254.5
ADJUSTMENTS		0.0	0.0	15.3	-48.6	33.3
TOTAL		3116.8	497.6	1548.4	783.0	287.8

TABLE F-2
(CONTINUED)

ALLOCATION OF FY80 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		94.9	1.9	59.5	23.2	10.2
F&E	CENTERS	126.0	0.0	90.7	12.6	22.7
	TOWERS	113.2	1.9	60.1	36.7	14.5
	FSS	49.0	0.0	2.5	46.6	0.0
	NAVAIDS	62.5	0.0	33.7	20.6	8.1
	OTHER	33.3	0.0	22.3	11.0	0.0
	TOTAL F&E	383.9	1.9	209.3	127.5	45.3
O&M	CENTERS	649.6	65.4	313.2	160.0	111.0
	TOWERS	605.3	50.6	286.2	230.1	38.4
	FSS	134.1	4.6	6.5	110.2	12.8
	OTHER	84.0	7.9	36.3	30.0	9.7
	TOTAL O&M	1473.0	128.5	642.2	530.3	172.0
SUPPORT	I&M	192.7	50.2	68.1	56.2	18.2
	ADM F ST	202.6	202.6	0.0	0.0	0.0
	AEM MED	12.2	12.2	0.0	0.0	0.0
	DEV DIR	9.7	0.0	6.2	2.4	1.1
	A-P ADM	31.6	2.6	25.0	4.0	0.0
	CENT TRN	108.6	32.1	37.1	29.8	9.6
	DIR, S&S	193.6	38.6	81.3	55.7	18.1
	TOTAL SUP	750.9	338.4	217.7	148.2	47.0
FE&D		26.0	26.0	0.0	0.0	0.0
NTL CAP AP		36.3	36.3	0.0	0.0	0.0
GRANTS		625.0	0.0	537.9	87.1	0.0
TOTAL		3389.9	532.6	1666.6	916.3	274.4
ADJUSTMENTS		0.0	0.0	16.7	-53.3	36.7
TOTAL		3389.9	532.6	1683.2	863.0	311.1

TABLE F-2
(CONTINUED)

ALLOCATION OF FY81 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		100.4	2.0	62.9	24.6	40.8
F&E	CENTERS	103.8	0.0	74.7	40.4	48.7
	TOWERS	124.9	2.0	66.3	40.5	16.0
	FSS	54.0	0.0	2.7	51.3	0.0
	NAVAIDS	66.3	0.0	35.8	21.9	8.6
	OTHER	34.8	0.0	23.3	11.5	0.0
	TOTAL F&E	383.8	2.0	202.9	135.6	43.3
O&M	CENTERS	729.0	70.9	348.7	190.8	119.4
	TOWERS	669.2	53.5	314.6	260.4	40.6
	FSS	139.0	4.9	6.7	114.2	13.3
	OTHER	90.9	8.4	39.2	33.4	10.1
	TOTAL O&M	1628.1	136.9	709.2	598.6	183.4
SUPPORT	I&M	214.3	54.2	76.2	64.3	19.7
	ADM F ST	220.7	220.7	0.0	0.0	0.0
	ACM MED	13.3	13.3	0.0	0.0	0.0
	DEV DIR	10.3	0.0	6.6	2.6	1.1
	A-P ADM	33.8	2.7	26.7	4.4	0.0
	CENT TRN	119.9	33.9	41.5	34.4	10.4
	DIR, S&S	212.0	40.8	89.2	62.7	19.3
	TOTAL SUP	824.4	365.6	240.1	168.2	50.5
FE&D		27.5	27.5	0.0	0.0	0.0
NTL CAP AP		38.4	38.4	0.0	0.0	0.0
GRANTS		645.0	0.0	552.9	92.1	0.0
TOTAL		3647.4	572.3	1768.0	1019.0	288.0
ADJUSTMENTS		0.0	0.0	17.7	-58.4	40.8
TOTAL		3647.4	572.3	1785.7	960.6	328.8

TABLE F-2
(CONTINUED)

ALLOCATION OF FY82 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		106.0	2.1	66.4	26.0	11.4
F&E	CENTERS	62.3	0.0	44.8	6.2	11.2
	TOWERS	140.2	2.1	58.4	35.7	44.1
	FSS	58.0	0.0	2.9	55.1	0.0
	NAVAIDS	62.3	0.0	33.6	20.5	8.1
	OTHER	36.2	0.0	24.3	11.9	0.0
	TOTAL F&E	329.0	2.1	164.0	129.5	33.4
O&M	CENTERS	803.7	77.0	383.1	216.8	126.8
	TOWERS	738.1	56.6	340.9	297.4	43.2
	FSS	143.7	5.1	6.9	118.0	13.7
	OTHER	97.9	8.8	42.1	36.4	10.6
	TOTAL O&M	1783.3	147.6	773.0	668.5	194.2
SUPPORT	I&M	236.2	59.3	83.6	72.3	21.0
	ADM P ST	240.3	240.3	0.0	0.0	0.0
	AIR MED	14.9	14.9	0.0	0.0	0.0
	DEV DIR	10.8	0.0	6.9	2.7	1.2
	A-P ADM	36.4	2.9	28.7	4.8	0.0
	CERT TRN	131.2	35.8	45.7	38.6	11.1
	DIR, S&S	230.5	43.1	96.8	70.0	20.6
	TOTAL SUP	900.4	396.3	261.8	188.4	53.9
RE&D		29.0	29.0	0.0	0.0	0.0
NTL CAP AP		40.5	40.5	0.0	0.0	0.0
GRANTS		675.0	0.0	577.9	97.1	0.0
TOTAL		3863.1	617.6	1843.1	1109.5	292.9
ADJUSTMENTS		0.0	0.0	18.4	-62.8	44.4
TOTAL		3863.1	617.6	1861.6	1046.7	337.3

TABLE F-2
(CONTINUED)

ALLOCATION OF FY83 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		111.7	2.3	70.0	27.4	12.0
F&E	CENTERS	81.4	0.0	58.6	8.1	14.7
	TOWERS	108.8	2.2	57.6	35.2	13.9
	FSS	50.0	0.0	2.5	47.5	0.0
	NAVAIDS	62.2	0.0	33.6	20.5	8.1
	OTHER	37.5	0.0	25.1	12.4	0.0
	TOTAL F&E	339.9	2.2	177.4	123.7	36.6
O&M	CENTERS	867.7	83.1	413.1	237.5	134.0
	TOWERS	803.5	60.0	369.0	329.0	45.5
	FSS	148.2	5.4	7.1	121.5	14.2
	OTHER	104.5	9.3	44.9	39.2	11.0
	TOTAL O&M	1923.8	157.8	834.1	727.2	204.7
SUPPORT	I&M	255.9	64.9	90.2	78.6	22.1
	ADM F ST	260.2	260.2	0.0	0.0	0.0
	ACM MED	16.4	16.4	0.0	0.0	0.0
	DEV DIR	11.4	0.0	7.3	2.9	1.3
	A-P ADM	39.1	3.0	30.8	5.2	0.0
	CENT TRN	141.5	37.7	49.7	42.3	11.8
	DIR, S&S	247.7	45.4	104.2	76.2	21.8
	TOTAL SUP	972.1	427.6	282.3	205.2	57.0
RE&D		30.6	30.6	0.0	0.0	0.0
NTL CAP AP		42.7	42.7	0.0	0.0	0.0
GRANTS		705.0	0.0	602.9	102.1	0.0
[illegible]		4125.8	663.1	1966.7	1185.6	310.4
ADJUSTMENTS		0.0	0.0	19.7	-67.1	47.4
TOTAL		4125.8	663.1	1986.	1118.5	357.6

TABLE F-2
(CONTINUED)

ALLOCATION OF FY84 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		117.7	2.4	73.8	28.8	12.7
F&E	CENTERS	93.4	0.0	67.2	9.3	16.8
	TOWERS	114.5	2.3	60.6	37.0	14.6
	FSS	58.0	0.0	2.9	55.1	0.0
	NAVAIDS	62.0	0.0	33.5	20.5	8.1
	OTHER	38.6	0.0	26.0	12.8	0.0
	TOTAL F&E	366.7	2.3	190.2	134.8	39.5
O&M	CENTERS	941.6	87.4	447.6	264.2	142.4
	TOWERS	870.9	64.0	398.2	360.8	47.8
	FSS	152.8	5.7	7.3	125.1	14.7
	OTHER	111.6	9.8	48.0	42.2	11.5
	TOTAL O&M	2076.8	167.0	901.1	792.3	216.4
SUPPORT	I&M	277.5	71.0	97.5	85.7	23.4
	ADM F ST	280.0	280.0	0.0	0.0	0.0
	ADM HED	17.7	17.7	0.0	0.0	0.0
	DEV DIR	12.0	0.0	7.7	3.0	1.3
	A-P ADM	42.1	3.2	33.3	5.6	0.0
	CENT TRN	152.8	39.8	54.0	46.4	12.6
	DIR, S&S	266.3	47.8	112.3	83.1	23.1
	TOTAL SUP	1048.4	459.4	304.7	223.8	60.4
FE&D		32.2	32.2	0.0	0.0	0.0
NTL CAP AP		45.0	45.0	0.0	0.0	0.0
GRANTS		740.0	0.0	632.9	107.1	0.0
TOTAL		4426.8	708.2	2102.7	1286.9	329.0
ADJUSTMENTS		0.0	0.0	21.0	-72.5	51.5
TOTAL		4426.8	708.2	2123.7	1214.4	380.5

TABLE F-2
(CONTINUED)

ALLOCATION OF FY85 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		124.4	2.5	78.0	30.5	13.4
F&E	CENTERS	116.3	0.0	83.7	11.6	20.9
	TOWERS	116.5	2.4	64.7	37.7	14.8
	FSS	50.0	0.0	2.5	47.5	0.0
	NAVAIDS	62.4	0.0	33.7	20.6	8.1
	OTHER	40.5	0.0	27.1	13.4	0.0
	TOTAL F&E	385.8	2.4	208.7	130.8	43.9
O&M	CENTERS	1026.6	94.4	489.9	291.3	151.0
	TOWERS	945.9	68.4	432.8	394.7	50.2
	FSS	157.9	6.0	7.5	129.1	15.2
	OTHER	109.6	10.4	58.8	45.4	12.0
	TOTAL O&M	2250.0	179.0	982.0	860.5	228.5
SUPPORT	I&M	301.8	77.7	106.3	93.1	24.7
	ADM F ST	304.1	304.1	0.0	0.0	0.0
	ACM MED	19.3	19.3	0.0	0.0	0.0
	DEV DIR	12.7	0.0	8.1	3.2	1.4
	A-F ADM	45.5	3.3	36.0	6.1	0.0
	CENT TRN	165.5	42.0	59.3	50.8	13.4
	DIR, S&S	287.2	50.6	121.8	90.3	24.5
	TOTAL SUP	1136.0	497.0	331.5	243.5	64.0
FE&D		34.1	34.1	0.0	0.0	0.0
NTL CAP AP		47.5	47.5	0.0	0.0	0.0
GRANTS		775.0	0.0	662.9	112.1	0.0
TOTAL		4752.7	762.4	2263.1	1377.4	349.7
ADJUSTMENTS		0.0	0.0	22.6	-77.7	55.1
TOTAL		4752.7	762.4	2285.8	1299.7	404.8

TABLE F-2
(CONCLUDED)

ALLOCATION OF FY86 BASELINE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		134.0	2.6	82.1	32.1	14.1
F&E	CENTERS	431.3	0.0	94.5	13.1	23.6
	TOWERS	124.9	2.5	66.1	40.4	15.9
	FSS	30.0	0.0	1.5	28.5	0.0
	NAVAIDS	63.4	0.0	34.2	20.9	8.2
	OTHER	42.5	0.0	28.5	14.0	0.0
	TOTAL F&E	392.1	2.5	224.9	117.0	47.8
O&M	CENTERS	1120.4	101.4	537.5	321.8	159.7
	TOWERS	1021.1	71.9	468.5	428.1	52.6
	FSS	162.5	6.3	7.7	132.8	15.6
	OTHER	127.8	10.9	55.8	48.6	12.5
	TOTAL O&M	2431.8	190.6	1069.4	931.3	240.4
SUPPORT	I&M	327.6	84.4	116.0	101.0	26.1
	ADM P ST	329.0	329.0	0.0	0.0	0.0
	ADM MED	21.0	21.0	0.0	0.0	0.0
	DEV DIR	13.4	0.0	8.6	3.3	1.5
	A-P ADM	48.7	3.5	38.6	6.6	0.0
	CENT TRN	178.7	44.3	64.9	55.4	14.2
	DIR, S&S	309.0	53.2	132.0	97.8	25.8
	TOTAL SUP	1227.4	535.5	360.2	264.1	67.6
FE&D		35.9	35.9	0.0	0.0	0.0
NTL CAP AP		50.1	50.1	0.0	0.0	0.0
GRANTS		805.0	0.0	687.8	117.2	0.0
TOTAL		5073.2	817.1	2424.4	1461.7	369.9
ADJUSTMENTS		0.0	0.0	24.2	-82.7	58.5
TOTAL		5073.2	817.1	2448.7	1379.0	428.4

TABLE F-3

ALLOCATION OF FY77 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		69.6	1.5	43.6	17.0	7.5
F&E	CENTERS	43.8	0.0	31.5	4.4	7.9
	TOWERS	78.4	1.5	41.5	25.4	10.0
	FSS	15.4	0.0	0.8	14.7	0.0
	NAVAIDS	33.9	0.0	18.3	11.2	4.4
	OTHER	16.9	0.0	11.4	5.6	0.0
	TOTAL F&E	188.4	1.5	103.5	61.2	22.3
O&M	CENTERS	474.9	51.7	234.1	98.2	91.0
	TOWERS	443.0	37.9	216.5	157.1	31.5
	FSS	107.2	3.6	5.4	87.7	10.5
	OTHER	62.5	6.2	27.6	20.7	8.0
	TOTAL O&M	1087.6	99.4	483.5	363.6	141.0
SUPPORT	I&M	136.1	36.1	48.9	36.8	14.3
	ACM F ST	142.3	142.3	0.0	0.0	0.0
	ACM RED	8.5	8.5	0.0	0.0	0.0
	DEV DIR	6.7	0.0	4.3	1.7	0.7
	A-P ADM	18.9	2.0	14.6	2.3	0.0
	CENT TRN	71.6	25.1	23.2	16.9	6.5
	DIR, S&S	140.8	30.2	59.5	37.0	14.1
	TOTAL SUP	524.9	244.3	450.4	94.7	35.5
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		490.9	0.0	423.5	67.4	0.0
TOTAL		2410.1	395.4	1204.5	603.9	206.
ADJUSTMENTS		0.0	0.0	12.0	-36.2	24.
TOTAL		2410.1	395.4	1216.5	567.7	230.

TABLE F-3
(CONTINUED)

ALLOCATION OF FY78 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	55.0	0.0	39.6	5.5	9.9
	TOWERS	76.0	1.5	40.2	24.6	9.7
	FSS	43.0	0.0	2.1	40.8	0.0
	NAVAIDS	50.0	0.0	27.0	16.5	6.5
	OTHER	26.0	0.0	17.4	8.6	0.0
	TOTAL F&E	250.0	1.5	126.4	96.0	26.1
O&M	CENTERS	488.0	52.3	238.9	108.3	88.5
	TOWERS	440.9	38.1	211.4	161.3	30.1
	FSS	107.2	3.6	5.3	87.9	10.4
	OTHER	63.7	6.2	27.8	21.8	7.9
	TOTAL O&M	1099.8	100.2	483.4	379.3	136.9
SUPPORT	I&M	144.3	37.1	51.8	40.7	14.7
	ADM P ST	150.7	150.7	0.0	0.0	0.0
	ACD MED	9.1	9.1	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	23.6	2.0	18.6	3.0	0.0
	CENT TRN	81.3	25.1	27.6	21.1	7.5
	DIR, S&S	146.3	30.2	61.7	40.1	14.3
	TOTAL SUP	562.7	254.1	164.5	106.7	37.3
RE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		488.6	0.0	420.7	67.8	0.0
TOTAL		2524.2	406.1	1241.7	668.1	208.3
ADJUSTMENTS		0.0	0.0	12.4	-39.1	26.7
TOTAL		2524.2	406.1	1254.1	628.9	235.1

TABLE F-3
(CONTINUED)

ALLOCATION OF FY79 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	49.0	0.0	35.3	4.9	8.8
	TOWERS	107.0	1.5	57.0	34.8	13.7
	FSS	49.0	0.0	2.4	46.5	0.0
	NAVAIDS	73.0	0.0	39.4	24.1	9.5
	OTHER	28.0	0.0	18.8	9.2	0.0
	TOTAL F&E	306.0	1.5	152.9	119.6	32.0
O&M	CENTERS	496.8	51.2	242.2	115.7	87.7
	TOWERS	455.5	39.2	217.2	169.0	30.0
	FSS	107.2	3.6	5.2	88.1	10.2
	OTHER	64.6	6.2	28.1	22.6	7.7
	TOTAL O&M	1124.1	100.2	492.7	395.4	135.7
SUPPORT	I&R	147.0	38.3	52.3	42.0	14.4
	ADM F ST	154.7	154.7	0.0	0.0	0.0
	AIR MED	9.3	9.3	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	24.1	2.0	19.1	3.1	0.0
	CENT TRN	82.9	25.1	28.2	22.0	7.5
	DIR, S&S	148.6	30.2	62.6	41.6	14.2
	TOTAL SUP	574.3	259.7	167.0	110.6	37.0
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		484.8	0.0	417.4	67.4	0.0
TOTAL		2612.2	411.6	1276.6	711.3	212.7
ADJUSTMENTS		0.0	0.0	12.8	-41.2	28.5
TOTAL		2612.2	411.6	1289.4	670.0	241.2

TABLE F-3
(CONTINUED)

ALLOCATION OF FY80 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	39.0	0.0	28.1	3.9	7.0
	TOWERS	104.0	1.5	55.3	33.8	13.3
	FSS	55.0	0.0	2.7	52.2	0.0
	NAVAIDS	94.0	0.0	50.8	31.0	12.2
	OTHER	25.0	0.0	16.7	8.2	0.0
	TOTAL F&E	317.0	1.5	153.7	129.2	32.6
O&M	CENTERS	508.7	51.2	245.2	125.3	86.9
	TOWERS	474.0	39.6	224.1	180.2	30.1
	FSS	105.0	3.6	5.1	86.3	10.0
	OTHER	65.8	6.2	28.4	23.5	7.6
	TOTAL O&M	1153.5	100.6	502.9	415.3	134.7
SUPPORT	I&M	150.9	39.3	53.3	44.0	14.3
	ADM F ST	158.6	158.6	0.0	0.0	0.0
	AEM MED	9.5	9.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-E ADM	24.7	2.0	19.5	3.2	0.0
	CENT TRN	85.0	25.4	29.1	23.4	7.5
	DIR, S&S	151.6	30.2	63.7	43.6	14.2
	TOTAL SUP	588.0	264.8	170.4	146.1	36.8
RE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		479.7	0.0	412.9	66.8	0.0
TOTAL		2661.2	417.1	1286.5	745.6	212.0
ADJUSTMENTS		0.0	0.0	12.9	-42.7	29.8
TOTAL		2661.2	417.1	1299.3	702.9	241.8

TABLE F-3
(CONTINUED)

ALLOCATION OF FY81 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	42.0	0.0	30.2	4.2	7.6
	TOWERS	107.0	1.5	57.0	34.8	13.7
	FSS	63.0	0.0	3.1	59.8	0.0
	NAVAIDS	89.0	0.0	48.1	29.4	11.6
	OTHER	27.0	0.0	18.1	8.9	0.0
	TOTAL F&E	328.0	1.5	156.5	137.1	32.8
O&M	CENTERS	518.6	51.9	245.4	137.3	84.0
	TOWERS	485.9	39.6	227.3	189.6	29.3
	FSS	102.9	3.6	4.9	84.5	9.8
	OTHER	61.0	6.2	25.8	22.3	6.7
	TOTAL O&M	1168.3	101.3	503.5	433.7	129.8
SUPPORT	I&M	151.3	40.1	52.5	45.2	13.5
	ADM F ST	463.4	463.4	0.0	0.0	0.0
	ADM MED	9.8	9.8	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	25.0	2.0	19.7	3.3	0.0
	CENT TRN	86.5	25.8	29.4	24.7	7.3
	DIR, S&S	153.6	30.2	64.0	45.6	13.8
	TOTAL SUP	597.2	270.6	170.5	120.6	35.5
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		465.7	0.0	399.2	66.5	0.0
TOTAL		2682.2	423.7	1276.3	776.2	206.1
ADJUSTMENTS		0.0	0.0	12.8	-43.8	31.0
TOTAL		2682.2	423.7	1289.0	732.4	237.2

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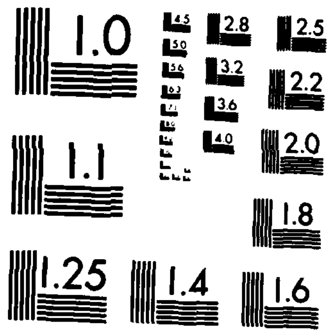

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TABLE F-3
(CONTINUED)

ALLOCATION OF FY82 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	43.0	0.0	31.0	4.3	7.7
	TOWERS	133.0	1.5	71.0	43.4	17.1
	FSS	57.0	0.0	2.8	54.1	0.0
	NAVAIDS	74.0	0.0	38.3	23.4	9.2
	OTHER	29.0	0.0	19.4	9.6	0.0
	TOTAL F&E	333.0	1.5	162.6	134.8	34.1
O&M	CENTERS	522.4	54.0	243.7	144.0	80.6
	TOWERS	498.3	39.7	227.9	201.8	28.9
	FSS	100.7	3.6	4.8	82.7	9.6
	OTHER	55.9	6.2	23.4	20.8	5.8
	TOTAL O&M	1177.3	103.5	499.5	449.4	124.9
SUPPORT	I&M	151.0	41.6	50.9	45.8	12.7
	ACH P ST	168.5	168.5	0.0	0.0	0.0
	ACH MED	10.5	10.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	25.5	2.0	20.1	3.4	0.0
	CENT TRN	87.5	25.4	29.5	25.8	7.1
	DIR, S&S	155.0	30.2	64.0	47.4	13.4
	TOTAL SUP	605.6	277.9	169.4	124.2	34.1
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		463.0	0.0	396.3	66.6	0.0
TOTAL		2701.9	433.1	1274.4	793.3	201.1
ADJUSTMENTS		0.0	0.0	12.7	-44.5	31.7
TOTAL		2701.9	433.1	1287.2	748.8	232.8

TABLE F-3
(CONTINUED)

ALLOCATION OF FY83 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	37.0	0.0	26.6	3.7	6.7
	TOWERS	149.0	1.5	79.6	48.7	19.2
	FSS	39.0	0.0	1.9	37.0	0.0
	NAVAIDS	80.0	0.0	43.2	26.4	10.4
	OTHER	32.0	0.0	21.4	10.6	0.0
	TOTAL F&E	337.0	1.5	172.9	126.4	36.2
O&M	CENTERS	517.5	55.3	238.6	146.2	77.4
	TOWERS	505.5	39.9	228.7	208.7	28.2
	FSS	98.6	3.6	4.7	80.8	9.5
	OTHER	50.5	6.2	20.5	18.9	5.0
	TOTAL O&M	1072.1	105.0	492.5	454.6	120.0
SUPPORT	IGM	148.8	43.2	48.7	45.0	11.9
	ADM F ST	173.1	173.1	0.0	0.0	0.0
	AVN MED	10.9	10.9	0.0	0.0	0.0
	ERV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	26.0	2.0	20.5	3.5	0.0
	CENT TRN	87.6	25.1	29.3	26.3	6.9
	DIR, S&S	155.0	30.2	63.6	48.1	13.0
	TOTAL SUP	609.0	284.5	167.1	124.8	32.6
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		461.4	0.0	394.5	66.8	0.0
TOTAL		2702.5	441.2	1273.6	790.8	196.9
ADJUSTMENTS		0.0	0.0	12.7	-44.4	31.6
TOTAL		2702.5	441.2	1286.3	746.4	228.5

TABLE F-3
(CONTINUED)

ALLOCATION OF FY84 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	61.0	0.0	43.9	6.1	11.0
	TOWERS	122.0	1.5	65.1	39.8	15.7
	FSS	32.0	0.0	1.6	30.4	0.0
	NAVAIDS	90.0	0.0	48.6	29.7	11.7
	OTHER	38.0	0.0	25.5	12.5	0.0
	TOTAL F&E	343.0	1.5	184.6	118.5	38.3
O&M	CENTERS	517.1	55.2	235.7	151.1	75.0
	TOWERS	511.3	40.4	229.3	214.0	27.5
	FSS	96.5	3.6	4.6	79.0	9.3
	OTHER	51.4	6.2	20.7	19.6	4.9
	TOTAL O&M	1176.2	105.4	490.4	463.7	116.7
SUPPORT	I&M	147.0	44.8	46.8	44.3	11.1
	ADM F ST	176.8	176.8	0.0	0.0	0.0
	AEM MED	11.2	11.2	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	26.6	2.0	21.0	3.6	0.0
	CENT TRN	87.9	25.1	29.2	26.9	6.7
	EIB, S&S	155.2	30.2	63.4	49.0	12.7
	TOTAL SUP	612.3	290.0	165.3	125.6	31.4
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		463.7	0.0	396.5	67.1	0.0
TOTAL		2718.2	447.2	1283.4	793.1	194.5
ADJUSTMENTS		0.0	0.0	12.8	-44.6	31.7
TOTAL		2718.2	447.2	1296.3	748.5	226.2

TABLE F-3
(CONTINUED)

ALLOCATION OF FY85 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	103.0	0.0	74.2	10.3	18.5
	TOWERS	117.0	1.5	62.4	38.1	15.0
	FSS	17.0	0.0	0.8	16.1	0.0
	NAVAIDS	86.0	0.0	46.4	28.4	11.2
	OTHER	31.0	0.0	20.8	10.2	0.0
	TOTAL F&E	354.0	1.5	204.6	103.2	44.7
O&M	CENTERS	493.3	56.4	219.7	149.4	67.7
	TOWERS	511.4	40.7	227.8	216.5	26.4
	FSS	94.3	3.6	4.5	77.1	9.1
	OTHER	52.4	6.2	20.9	20.5	4.8
	TOTAL O&M	1151.4	106.9	472.9	463.6	108.0
SUPPORT	I&M	138.2	46.4	41.6	40.8	9.5
	ADM F ST	181.7	181.7	0.0	0.0	0.0
	ADM MED	11.5	11.5	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	27.2	2.0	21.5	3.6	0.0
	CENT TRN	86.1	25.1	28.1	26.8	6.2
	DIR, S&S	152.3	30.2	61.6	48.8	11.8
	TOTAL SUP	604.6	296.9	157.6	121.8	28.3
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		459.7	0.0	393.2	66.5	0.0
TOTAL		2692.6	455.5	1274.8	773.3	189.1
ADJUSTMENTS		0.0	0.0	12.7	-43.7	30.9
TOTAL		2692.6	455.5	1287.6	729.6	220.0

TABLE F-3
(CONCLUDED)

ALLOCATION OF FY86 ALTERNATIVE PROGRAM COSTS
FY76 CONSTANT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		74.3	1.5	46.6	18.2	8.0
F&E	CENTERS	116.0	0.0	83.5	11.6	20.9
	TOWERS	115.0	1.5	61.3	37.5	14.8
	FSS	17.0	0.0	0.8	16.1	0.0
	NAVAIDS	62.0	0.0	33.5	20.5	8.1
	OTHER	35.0	0.0	23.4	11.5	0.0
	TOTAL F&E	345.0	1.5	202.6	97.2	43.7
O&M	CENTERS	487.9	57.5	214.8	151.8	63.8
	TOWERS	515.9	40.8	229.3	220.1	25.7
	FSS	92.2	3.6	4.4	75.3	8.8
	OTHER	53.5	6.2	21.3	21.3	4.7
	TOTAL O&M	1149.5	108.1	469.8	468.5	103.1
SUPPORT	I&B	134.6	47.9	39.1	39.0	8.6
	ADM F ST	186.6	186.6	0.0	0.0	0.0
	AVN MED	11.9	11.9	0.0	0.0	0.0
	DEV DIR	7.6	0.0	4.9	1.9	0.8
	A-P ADM	27.6	2.0	21.9	3.7	0.0
	CENT TRN	85.9	25.1	27.9	27.0	5.9
	DIR, S&S	151.9	30.2	61.2	49.2	11.3
	TOTAL SUP	606.3	303.7	155.0	120.9	26.7
FE&D		20.3	20.3	0.0	0.0	0.0
NTL CAP AP		28.4	28.4	0.0	0.0	0.0
GRANTS		455.1	0.0	388.8	66.2	0.0
TOTAL		2678.9	463.6	1262.8	771.1	181.5
ADJUSTMENTS		0.0	0.0	12.6	-43.5	30.8
TOTAL		2678.9	463.6	1275.4	727.6	212.3

TABLE F-4

ALLOCATION OF FY77 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		75.0	1.6	47.0	18.4	8.1
F&E	CENTERS	46.5	0.0	33.5	4.6	8.4
	TOWERS	83.3	1.6	44.1	26.9	10.6
	FSS	16.4	0.0	0.8	15.6	0.0
	NAVAIDS	35.9	0.0	19.4	11.9	4.7
	OTHER	18.0	0.0	12.0	5.9	0.0
	TOTAL F&E	200.0	1.6	109.8	64.9	23.7
O&M	CENTERS	511.9	55.7	252.3	105.8	98.0
	TOWERS	477.5	40.9	233.4	169.3	34.0
	FSS	115.5	3.9	5.8	94.5	11.4
	OTHER	67.4	6.7	29.7	22.3	8.7
	TOTAL O&M	1172.4	107.2	521.2	392.0	152.0
SUPPORT	I&M	146.7	38.9	52.7	39.7	15.4
	ADM F ST	153.4	153.4	0.0	0.0	0.0
	ACM MED	9.2	9.2	0.0	0.0	0.0
	DEV DIR	7.2	0.0	4.6	1.8	0.8
	A-P ADM	20.4	2.2	15.7	2.5	0.0
	CENT TRN	77.2	27.4	25.0	18.2	7.0
	DIR, S&S	151.7	32.6	64.1	39.9	15.2
	TOTAL SUP	565.8	263.3	162.2	102.0	38.3
FE&D		21.9	21.9	0.0	0.0	0.0
NTL CAP AP		30.6	30.6	0.0	0.0	0.0
GRANTS		521.3	0.0	449.8	71.5	0.0
TOTAL		2587.1	426.2	1289.9	648.9	222.1
ADJUSTMENTS		0.0	0.0	12.9	-38.9	26.0
TOTAL		2587.1	426.2	1302.8	610.0	248.0

TABLE F-4
(CONTINUED)

ALLOCATION OF FY78 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		85.0	1.7	53.3	20.8	9.2
F&E	CENTERS	62.1	0.0	44.7	6.2	14.2
	TOWERS	84.8	1.7	44.9	27.4	10.8
	FSS	47.1	0.0	2.4	44.8	0.0
	NAVAIDS	54.8	0.0	29.6	18.1	7.1
	OTHER	28.5	0.0	19.1	9.4	0.0
	TOTAL F&E	277.3	1.7	140.7	105.9	29.1
O&M	CENTERS	558.3	59.8	273.3	123.9	101.2
	TOWERS	504.4	43.6	241.8	184.5	34.5
	FSS	122.6	4.1	6.0	100.5	11.9
	OTHER	72.9	7.1	31.8	25.0	9.0
	TOTAL O&M	1258.2	114.6	553.0	433.9	156.6
SUPPORT	I&M	165.1	42.4	59.3	46.5	16.8
	ADM P SY	172.4	172.4	0.0	0.0	0.0
	ADM MED	10.4	10.4	0.0	0.0	0.0
	DEV DIR	8.7	0.0	5.6	2.2	1.0
	A-P ADM	27.0	2.3	21.2	3.4	0.0
	CENT TRN	93.0	28.7	31.6	24.1	8.6
	DIR, S&S	167.3	34.5	70.5	45.9	16.4
	TOTAL SUP	643.8	290.7	188.2	122.1	42.7
F&ED		23.3	23.3	0.0	0.0	0.0
NTL CAP AP		32.5	32.5	0.0	0.0	0.0
GRANTS		555.0	0.0	478.0	77.0	0.0
TOTAL		2875.1	464.5	1413.2	759.8	237.6
ADJUSTMENTS		0.0	0.0	14.1	-44.5	30.4
TOTAL		2875.1	464.5	1427.3	715.3	268.0

TABLE F-4
(CONTINUED)

ALLOCATION OF FY79 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		89.8	1.8	56.3	22.0	9.7
F&E	CENTERS	59.2	0.0	42.6	5.9	10.7
	TOWERS	127.2	1.8	67.7	41.4	16.3
	FSS	56.9	0.0	2.8	54.4	0.0
	NAVAIDS	84.8	0.0	45.8	28.0	11.0
	OTHER	32.5	0.0	21.8	10.7	0.0
	TOTAL F&E	360.7	1.8	180.8	140.1	38.0
O&M	CENTERS	600.6	61.9	292.8	139.9	106.1
	TOWERS	550.7	47.4	262.7	204.3	36.3
	FSS	129.6	4.4	6.3	106.6	12.4
	OTHER	78.2	7.5	34.0	27.3	9.4
	TOTAL O&M	1359.0	121.1	595.7	478.1	164.1
SUPPORT	ISM	177.8	46.3	63.3	50.8	17.4
	ADM F ST	187.1	187.1	0.0	0.0	0.0
	ADM MED	11.3	11.3	0.0	0.0	0.0
	DEV DIR	9.2	0.0	5.9	2.3	1.0
	A-P ADM	29.2	2.4	23.0	3.7	0.0
	CENT TRN	100.2	30.3	34.1	26.7	9.1
	DIR, S&S	179.6	36.5	75.6	50.3	17.2
	TOTAL SUP	694.3	313.9	201.9	133.8	44.7
FESD		24.6	24.6	0.0	0.0	0.0
NTL CAP AP		34.3	34.3	0.0	0.0	0.0
GRANTS		590.0	0.0	508.0	82.0	0.0
TOTAL		3152.8	497.6	1542.7	856.0	256.5
ADJUSTMENTS		0.0	0.0	15.4	-49.7	34.2
TOTAL		3152.8	497.6	1558.2	806.3	290.7

TABLE F-4
(CONTINUED)

ALLOCATION OF FY80 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		94.9	1.9	59.5	23.2	10.2
F&E	CENTERS	50.3	0.0	36.2	5.0	9.0
	TOWERS	130.7	1.9	69.6	42.5	16.7
	FSS	66.7	0.0	3.3	63.4	0.0
	NAVAIDS	114.0	0.0	61.6	37.6	14.8
	OTHER	30.3	0.0	20.3	10.0	0.0
	TOTAL F&E	392.0	1.9	191.0	158.5	40.6
O&M	CENTERS	649.6	65.4	313.2	160.0	111.0
	TOWERS	605.3	50.6	286.2	230.1	38.4
	FSS	134.1	4.6	6.5	110.2	12.8
	OTHER	84.0	7.9	36.3	30.0	9.7
	TOTAL O&M	1473.0	428.5	642.2	530.3	172.0
SUPPORT	I&M	192.7	50.2	68.1	56.2	18.2
	ADM P ST	202.6	202.6	0.0	0.0	0.0
	ADM MED	12.2	12.2	0.0	0.0	0.0
	DEV DIR	9.7	0.0	6.2	2.4	1.1
	A-P ADM	31.6	2.6	25.0	4.0	0.0
	CERT TRN	108.6	32.1	37.1	29.8	9.6
	DIR, S&S	193.6	38.6	81.3	55.7	18.1
	TOTAL SUP	750.9	338.4	217.7	148.2	47.0
PE&D		26.0	26.0	0.0	0.0	0.0
NTL CAP AP		36.3	36.3	0.0	0.0	0.0
GRANTS		625.0	0.0	537.9	87.1	0.0
TOTAL		3398.1	532.6	1648.3	947.4	269.8
ADJUSTMENTS		0.0	0.0	16.5	-54.4	37.9
TOTAL		3398.1	532.6	1664.8	893.0	307.7

TABLE F-4
(CONTINUED)

ALLOCATION OF FY81 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		100.4	2.0	62.9	24.6	10.8
F&E	CENTERS	57.4	0.0	41.3	5.7	10.3
	TOWERS	141.7	2.0	75.5	46.0	18.2
	FSS	79.9	0.0	4.0	75.9	0.0
	NAVAIDS	112.9	0.0	60.9	37.2	14.7
	OTHER	34.2	0.0	22.9	11.3	0.0
	TOTAL F&E	426.1	2.0	204.7	176.3	43.2
O&M	CENTERS	700.6	70.1	331.5	185.5	113.5
	TOWERS	656.4	53.5	307.1	256.2	39.6
	FSS	139.0	4.9	6.7	114.2	13.2
	OTHER	82.4	8.4	34.9	30.1	9.0
	TOTAL O&M	1578.4	136.9	680.2	586.0	175.4
SUPPORT	I&M	204.4	54.2	70.9	61.1	18.3
	ADM F ST	220.7	220.7	0.0	0.0	0.0
	ADM MED	13.3	13.3	0.0	0.0	0.0
	DEV DIR	10.3	0.0	6.6	2.6	1.1
	A-P ADM	33.8	2.7	26.7	4.4	0.0
	CENT TRN	116.8	33.9	39.7	33.3	9.9
	LIB, SGS	207.5	40.8	86.5	61.6	18.6
	TOTAL SUP	806.8	365.6	230.3	163.0	47.9
FE&D		27.5	27.5	0.0	0.0	0.0
NTL CAP AP		38.4	38.4	0.0	0.0	0.0
GRANTS		645.0	0.0	552.9	92.1	0.0
TOTAL		3622.5	572.3	1731.0	1041.9	277.3
ADJUSTMENTS		0.0	0.0	17.3	-59.0	41.7
TOTAL		3622.5	572.3	1748.3	982.9	318.9

TABLE F-4
(CONTINUED)

ALLOCATION OF FY82 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		106.0	2.1	66.4	26.0	14.4
F&E	CENTERS	61.8	0.0	44.5	6.2	11.1
	TOWERS	184.4	2.1	98.4	60.2	23.7
	FSS	75.2	0.0	3.8	71.4	0.0
	NAVAIDS	93.6	0.0	50.6	30.9	12.2
	OTHER	38.3	0.0	25.6	12.6	0.0
	TOTAL F&E	453.2	2.1	222.9	181.3	47.0
O&M	CENTERS	744.9	77.0	347.5	205.4	115.0
	TOWERS	710.5	56.6	325.0	287.8	41.2
	FSS	143.7	5.1	6.9	118.0	13.7
	OTHER	79.8	8.8	33.0	29.7	8.2
	TOTAL O&M	1678.9	147.6	712.3	640.8	178.1
SUPPORT	I&M	215.3	59.3	72.6	65.3	18.1
	ADM P ST	240.3	240.3	0.0	0.0	0.0
	AVN MED	14.9	14.9	0.0	0.0	0.0
	DEV DIR	10.8	0.0	6.9	2.7	1.2
	A-P ADM	36.4	2.9	28.7	4.8	0.0
	CERT TRN	124.8	35.8	42.0	36.8	10.2
	DIR, S&S	221.0	43.1	91.3	67.5	19.1
	TOTAL SUP	863.5	396.3	241.5	177.2	48.6
FE&D		29.0	29.0	0.0	0.0	0.0
NTL CAP AP		40.5	40.5	0.0	0.0	0.0
GRANTS		675.0	0.0	577.9	97.1	0.0
TOTAL		3846.1	617.6	1821.0	1122.4	285.1
ADJUSTMENTS		0.0	0.0	18.2	-63.1	44.9
TOTAL		3846.1	617.6	1839.3	1059.3	330.0

TABLE F-4
(CONTINUED)

ALLOCATION OF FY83 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		114.7	2.3	70.0	27.4	12.0
F&E	C?? S	55.6	0.0	40.0	5.6	10.0
	?(	215.2	2.2	115.1	70.3	27.7
	?	53.3	0.0	2.7	50.6	0.0
	DS	109.3	0.0	59.0	36.1	14.2
	?	43.7	0.0	29.3	14.4	0.0
	TAL F&E	477.1	2.2	246.1	177.0	51.9
O&M	CENTERS	777.8	83.1	358.6	219.8	116.3
	TOWERS	759.8	60.0	343.8	313.6	42.4
	FSS	148.2	5.4	7.1	121.5	14.2
	OTHER	75.9	9.3	30.7	28.4	7.5
	TOTAL O&M	1764.7	157.8	740.2	683.2	180.4
SUPPORT	ISR	223.7	64.9	73.3	67.6	17.9
	ADM F ST	260.2	260.2	0.0	0.0	0.0
	ADM RED	16.4	16.4	0.0	0.0	0.0
	DEV DIS	11.4	0.0	7.3	2.9	1.3
	A-P ADM	39.1	3.0	30.8	5.2	0.0
	CENT TRN	134.7	37.7	44.1	39.6	10.4
	DIR, S&S	232.9	45.4	95.6	72.3	19.6
	TOTAL SUP	915.3	427.6	251.1	187.6	49.0
FE&D		30.6	30.6	0.0	0.0	0.0
NTL CAP AP		42.7	42.7	0.0	0.0	0.0
GRANTS		705.0	0.0	602.9	102.1	0.0
TOTAL		4044.1	663.1	1910.3	1177.3	293.4
ADJUSTMENTS		0.0	0.0	19.1	-66.2	47.1
TOTAL		4044.1	663.1	1929.4	1111.1	340.5

TABLE F-4
(CONTINUED)

ALLOCATION OF FY84 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		117.7	2.4	73.8	28.8	12.7
F&E	CENTERS	95.6	0.0	68.9	9.6	17.2
	TOWERS	183.2	2.3	97.7	59.7	23.5
	FSS	45.2	0.0	2.3	43.0	0.0
	NAVAIDS	427.2	0.0	68.7	42.0	16.5
	OTHER	53.7	0.0	36.0	17.7	0.0
	TOTAL F&E	504.9	2.3	273.5	171.9	57.3
O&M	CENTERS	819.0	87.4	373.4	239.4	118.8
	TOWERS	809.9	64.0	363.2	339.0	43.6
	FSS	452.8	5.7	7.3	125.1	14.7
	OTHER	81.5	9.8	32.8	31.0	7.8
	TOTAL O&M	4863.1	467.0	776.7	734.5	184.9
SUPPORT	I&M	232.9	71.0	74.2	70.1	17.7
	ADM F ST	280.0	280.0	0.0	0.0	0.0
	ADM HEC	17.7	17.7	0.0	0.0	0.0
	DEV DIR	42.0	0.0	7.7	3.0	1.3
	A-P ADM	42.1	3.2	33.3	5.6	0.0
	CENT TRN	139.3	39.8	46.3	42.6	10.6
	DIR, S&S	245.9	47.8	400.4	77.5	20.1
	TOTAL SUP	969.9	459.4	261.8	198.9	49.7
FE&D		32.2	32.2	0.0	0.0	0.0
NTL CAP AP		45.0	45.0	0.0	0.0	0.0
GRANTS		740.0	0.0	632.9	107.1	0.0
TOTAL		4272.8	708.2	2018.7	1241.3	304.6
ADJUSTMENTS		0.0	0.0	20.2	-69.8	49.7
TOTAL		4272.8	708.2	2038.9	1171.5	354.3

TABLE F-4
(CONTINUED)

ALLOCATION OF FY85 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN BILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		124.4	2.5	78.0	30.5	13.4
F&E	CENTERS	170.3	0.0	122.6	17.0	30.7
	TOWERS	184.6	2.4	98.4	60.1	23.7
	FSS	25.1	0.0	1.3	23.8	0.0
	NAVAIDS	126.9	0.0	68.5	41.9	16.5
	OTHER	45.8	0.0	30.7	15.1	0.0
	TOTAL F&E	552.7	2.4	321.5	158.0	70.8
O&M	CENTERS	825.7	94.4	367.8	250.1	113.4
	TOWERS	856.1	68.1	381.3	362.5	44.2
	FSS	157.9	6.0	7.5	129.1	15.2
	OTHER	87.8	10.4	35.0	34.4	8.0
	TOTAL O&M	1927.5	179.0	791.7	776.1	180.8
SUPPORT	I&M	231.4	77.7	69.6	68.2	15.9
	ADM F ST	304.1	304.1	0.0	0.0	0.0
	ADM MED	19.3	19.3	0.0	0.0	0.0
	DEV DIR	42.7	0.0	8.1	3.2	1.4
	A-P ADM	45.5	3.3	36.0	6.1	0.0
	CENT TRN	144.2	42.0	47.0	44.8	10.4
	DIR, S&S	255.0	50.6	103.0	81.6	19.8
	TOTAL SUP	1012.2	497.0	263.8	203.9	47.4
FE&D		34.1	34.1	0.0	0.0	0.0
NTL CAP AP		47.5	47.5	0.0	0.0	0.0
GRANTS		775.0	0.0	662.9	112.1	0.0
TOTAL		4473.3	762.4	2117.8	1280.6	312.5
ADJUSTMENTS		0.0	0.0	21.2	-72.4	51.2
TOTAL		4473.3	762.4	2139.0	1208.2	363.7

TABLE F-4
(CONCLUDED)

ALLOCATION OF FY86 ALTERNATIVE PROGRAM COSTS
CURRENT DOLLARS IN MILLIONS

		TOTAL	PUBLIC	A.C.	G.A.	MIL/GOVT
R&D		131.0	2.6	82.1	32.1	14.1
F&E	CENTERS	201.3	0.0	144.9	20.1	36.2
	TOWERS	190.5	2.5	101.5	62.0	24.4
	FSS	26.3	0.0	1.3	25.0	0.0
	NAVAIDS	96.1	0.0	51.9	31.7	12.5
	OTHER	54.2	0.0	36.3	17.9	0.0
	TOTAL F&E	568.4	2.5	336.0	156.8	73.2
O&M	CENTERS	860.2	101.4	378.6	267.7	112.5
	TOWERS	909.6	71.9	404.3	388.0	45.4
	FSS	162.5	6.3	7.7	132.8	15.6
	OTHER	94.3	10.9	37.6	37.5	8.3
	TOTAL O&M	2026.6	190.6	828.2	826.0	181.7
SUPPORT	I&M	237.4	84.4	69.0	68.8	15.1
	ADM F ST	329.0	329.0	0.0	0.0	0.0
	AEM MED	21.0	21.0	0.0	0.0	0.0
	DEV DIR	13.4	0.0	8.6	3.3	1.5
	A-P ADM	48.7	3.5	38.6	6.6	0.0
	CERT TRN	151.5	44.3	49.2	47.6	10.4
	DIR, S&S	267.9	53.2	107.9	86.7	20.0
	TOTAL SUP	1068.8	535.5	273.3	213.1	47.0
FE&D		35.9	35.9	0.0	0.0	0.0
NTL CAP AP		50.1	50.1	0.0	0.0	0.0
GRANTS		805.0	0.0	687.8	117.2	0.0
TOTAL		4685.8	817.1	2207.5	1345.2	316.0
ADJUSTMENTS		0.0	0.0	22.1	-75.9	53.8
TOTAL		4685.8	817.1	2229.5	1269.3	369.8

APPENDIX G

GLOSSARY

A.C./ AC	AIR CARRIER
A-P/ AP/ ARPT	AIRPORT
AAT	FAA AIR TRAFFIC SERVICE
ADAP	AIRPORT DEVELOPMENT AID PROGRAM
ADM/ ADMIN	ADMINISTRATION
ADV	ADVISORY
AFTN	AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK
AOPA	AIRCRAFT OWNERS AND PILOTS ASSOCIATION
ARSR	AIR ROUTE SURVEILLANCE RADAR
ARTCC	AIR ROUTE TRAFFIC CONTROL CENTER
ARTS	AUTOMATED RADAR TRAFFIC CONTROL SYSTEM
ASC	ADMINISTRATIVE SCIENCES CORPORATION
ASR	AIRPORT SURVEILLANCE RADAR
ATC	AIR TRAFFIC CONTROL
AVP	FAA OFFICE OF AVIATION POLICY
C-AP	CAPITOL AIRPORTS
CAB	CIVIL AERONAUTICS BOARD (SEE ALSO TRACAB)
CAP	CAPITOL
CENT	CENTRALIZED
CONUS	CONTINENTAL UNITED STATES
CSC	COMPUTER SCIENCES CORPORATION
CTR	CENTER (EN ROUTE)
DCA	WASHINGTON NATIONAL AIRPORT
DCS	DATA COMMUNICATIONS SYSTEM
DEV	DEVELOPMENT
DIR	DIRECTION
DME	DISTANCE MEASURING EQUIPMENT
DOD	DEPARTMENT OF DEFENSE
DOT	DEPARTMENT OF TRANSPORTATION
E&D	ENGINEERING AND DEVELOPMENT
F ST/ FLT STDS	FLIGHT STANDARDS
F&E	FACILITIES AND EQUIPMENT
F,E&D	FACILITIES, ENGINEERING AND DEVELOPMENT
FAA	FEDERAL AVIATION ADMINISTRATION
FAC	FACILITY
FREQ	FREQUENCY
FSS	FLIGHT SERVICE STATIONS
FY	FISCAL YEAR
G.A./ GA	GENERAL AVIATION
GAMA	GENERAL AVIATION MANUFACTURERS ASSOCIATION

GLOSSARY (contd.)

GOVT	GOVERNMENT
GRANTS	GRANTS-IN-AID
I&M/ IN & MAT	INSTALLATION AND MATERIAL
IAD	DULLES INTERNATIONAL AIRPORT
IFR	INSTRUMENT FLIGHT RULES
ILS	INSTRUMENT LANDING SYSTEM
JFK	JOHN F. KENNEDY INTERNATIONAL AIRPORT
LRIC	LONG RUN INCREMENTAL COST
LRMC	LONG RUN MARGINAL COST
MAINT	MAINTENANCE
MDW	CHICAGO MIDWAY AIRPORT
MED	MEDICAL (PROGRAMS)
MIL	MILITARY
MSL	MEAN SEA LEVEL
NAFEC	NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER
NAS	NATIONAL AIRSPACE SYSTEM
NASA	NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASP	NATIONAL AVIATION SYSTEM PLAN
NATL/ NTL	NATIONAL
NAVAIDS	NAVIGATION AIDS
NBAA	NATIONAL BUSINESS AIRCRAFT ASSOCIATION
NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NWS	NATIONAL WEATHER SERVICE
O&M	OPERATIONS AND MAINTENANCE
OPS	OPERATIONS
ORD	CHICAGO O'HARE INTERNATIONAL AIRPORT
OST	OFFICE OF THE SECRETARY OF TRANSPORTATION
PATWAS	PILOT'S AUTOMATIC TELEPHONE WEATHER ANSWERING SERVICE
PGP	AIRPORT PLANNING GRANT PROGRAM
R&D	RESEARCH AND DEVELOPMENT
R&M	RELOCATION AND MODIFICATION
R,E&D	RESEARCH, ENGINEERING AND DEVELOPMENT
RCAG	REMOTE COMMUNICATIONS, AIR TO GROUND
RCS	RADIO COMMUNICATIONS SYSTEM
RTR	REMOTE TRANSMITTER/RECEIVER
S.E.E.	STANDARD ESTIMATE OF ERROR

APPENDIX G

GLOSSARY (concluded)

S&S	STAFF AND SUPPORT
SRMC	SHORT RUN MARGINAL COSTS
SUP	SUPPORT
TACAN	TACTICAL AIR NAVIGATION AID
TCS	TECHNICAL CONTROL SERVICE
TR	TRAFFIC
TRACAB	TERMINAL RADAR CONTROL FACILITY COLOCATED WITH A CONTROL TOWER
TRACON	TERMINAL RADAR CONTROL FACILITY
TRN	TRAINING
TWEB	TRANSCRIBED WEATHER BROADCASTS
TWR	TOWER (TERMINAL)
U.S.	UNITED STATES
UG3RD	UPGRADED THIRD GENERATION
UHF	ULTRA HIGH FREQUENCY
UNICOM	AERONAUTICAL ADVISORY STATION
VCS	VOICE COMMUNICATIONS SYSTEM
VFR	VISUAL FLIGHT RULES
VHF	VERY HIGH FREQUENCY
VOR	VHF OMNI-RANGE (NAVIGATION AID)
VORTAC	COLOCATED VOR AND TACAN

APPENDIX H

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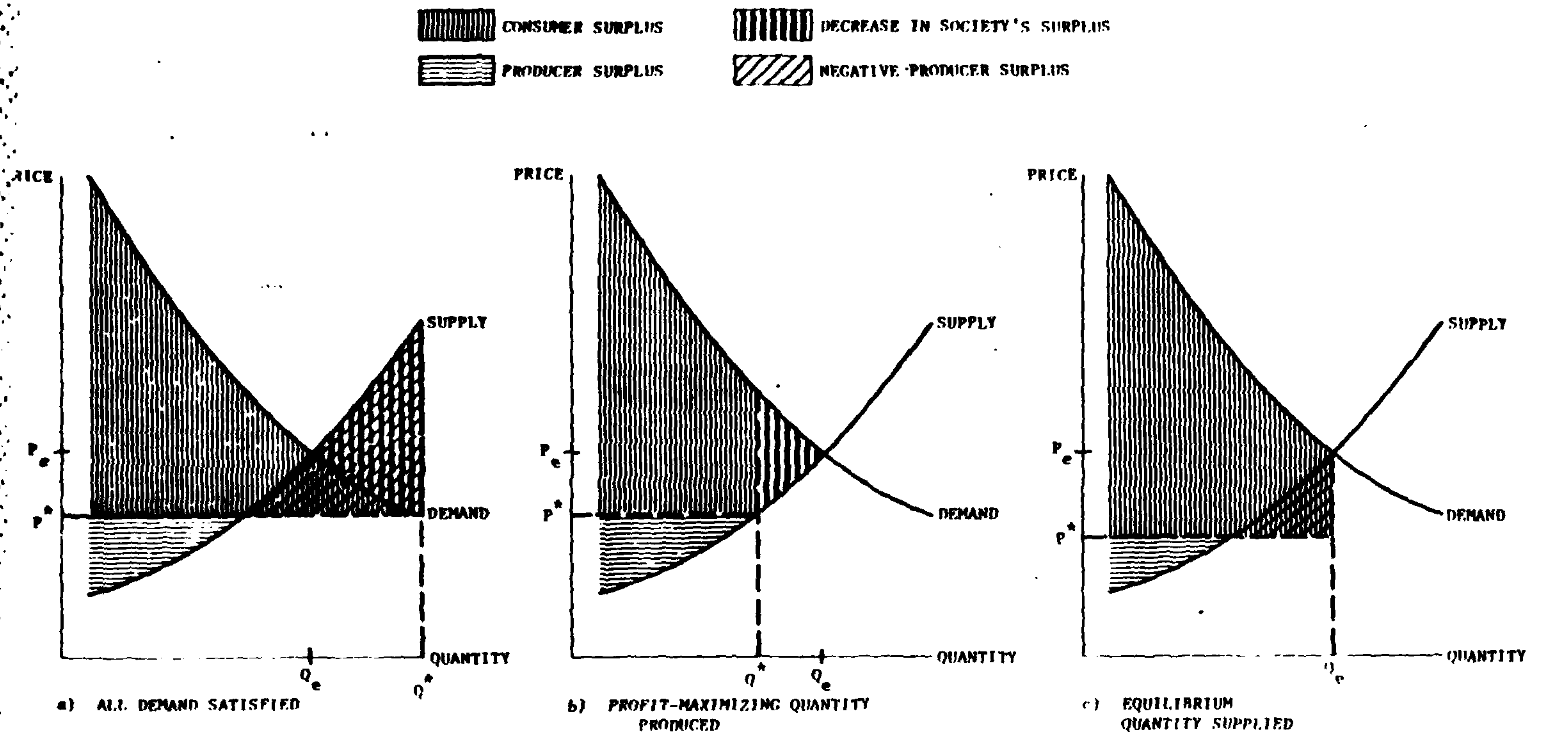

FIGURE A-4
CONSUMER AND PRODUCER SURPLUS
AT SUB-EQUILIBRIUM PRICES

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